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THE CONFERENCE OF MINISTERS OF AGRICULTURE.

During the month of May the Conference of Ministers of Agriculture was held in Adelaide, when delegates from all States of the Commonwealth were present. Representing Western Australia were the Honorary Minister, Mr. H. Millington, M.L.A., with the Director of Agriculture (Mr. Geo. L. Sutton), the Superintendent of Dairying (Mr. P. G. Hampshire), and the Superintendent of Horticulture (Mr. Geo. W. Wickens). The importance attachable to these conferences, which have now become annual, may be gauged from the numbers who attend. Realisation of the benefits to be derived speedily followed the preliminary meetings and each State now manifests its appreciation by sending as many delegates as circumstances will allow. The time of the officers attending is utilised in a way calculated to increase their knowledge, while contributing to the store of wisdom accumulated from experience in parts of the Commonwealth outside their own particular sphere of operations. Their duties, in their absence, are entrusted *pro tem* to capable deputies. Just as attrition polishes the hardest metal, so does intellectual intercourse brighten the mind, and the annual interchange of ideas and exchange of experiences tends to produce good feeling and create a general impulse towards higher attainment. Conference bestows the incalculable value of discussion on principles of vital interest to the agriculturist, while it enlightens all parties to the handicaps of particular States, the impracticability of applying a rule to cover conditions existing in widely separated territories, the necessity for tolerance where it is seen that opposition to some proposals does not necessarily imply antagonism, and the final blending and dovetailing of schemes to impart the highest benefit to all with the minimum disadvantage to any. It impresses not only the necessity for looking back and looking forward, but also to look around and observe what is as well as what has been and what should be.

The delegates to those conferences meet at a round table on terms of equality. Usually, the Premier of that State in which the venue has been arranged takes the opportunity of welcoming their presence and metaphorically bestowing his blessing upon their efforts. The appointment of a Chairman is as usually followed by the election of the Minister of Agriculture for that particular State, and the proceedings are fairly launched.

As a preliminary to entering upon the work laid down in the agenda paper, it has become the practice to review the labours of the last year's assemblage, an excellent principle, giving opportunity for those present to compare the effects following upon resolutions agreed upon at that time. Some of these, experience may have taught, did not work out so successfully as had been anticipated. Flies may appear in the ointment, and here is a way opened up whereby delegates from any State may illustrate the defects of local application, or, it may be, obtain further illumination on the experience of other States with a view to correcting misapprehension, should any exist.

Matters that affect Government policies are exclusively the demesne of Parliamentarians, and it may be that a deputy of the Federal Government is present to offer his guidance and advice where Commonwealth jurisdiction is involved. It is a notable feature that in almost every instance where a recommendation has been made by these Conferences, Commonwealth Officers dealing with their administration have adopted them loyally.

Ministers of Agriculture invariably evince a comprehensive knowledge, acquired during their period of administration, of subjects extraneous to the lay mind, but rarely do they enlarge upon these, deferring to their technically trained subordinates, whose knowledge specially qualifies them to sift the grain from the husk in the realms of scientific agriculture.

Much time that might otherwise be unprofitably spent, is conserved by the treatment of special subjects by specialist committees. After an examination of the agenda paper, allied items are segregated from the general mass and grouped together; then referred to these committees for exhaustive discussion and a recommendation to congress. All issues pertaining to the growth and marketing of fruit, for instance, are handed over to a committee of fruit experts. Similarly, the dairying industry and its problems of marketing products are dealt with by the Dairy Experts, while wheat and cereals are dealt with by those whose special knowledge entitles them to speak with authority. After full deliberation and the framing of resolutions for consideration by the Conference, recommendations are brought down to the general body and free discussion follows; but much of the spade work has been done by this time and the convocation may confine both thought and speech to the determination harvested from these Committees.

That a deep interest is displayed by the participants in these discussions, is demonstrated by the magnitude of the agenda paper itself. In 1926, when the Conference was held at Brisbane, 82 subjects were listed for dis-

cussion and several belated items were introduced at the closing hour of the Assembly. With few exceptions, each subject had some resolution framed for the adoption or rejection of the Conference, and in no case was anything resolved upon until after the subject matter had received full investigation as to its merit. The subjects listed and dealt with, included Permanent Standards of Wheat; the Determination of Milling Quality and Determination of Value of Flour and Wheat; Uniform Grade Standard for Eggs for Export; Uniform Standard of Copper Carbonate; Uniform Fertilisers; Unlform Legislation and Methods of Examination of Imported Seeds and Grain; Standardisation of Grading and Examination of Dairy Products; Co-ordination of Experimental Research Work; Uniform Herd Testing; Butter Preservatives; Arsenic Sprays; Regulation of Fruit Export and Destruction of Pests. These are but a few of the important items with which the Conference dealt.

In thanking the delegates for their attendance on that occasion, it is pertinent to quote the remarks of the Chairman and Minister for Agriculture for Queensland, on the value of these Conferences, who said, *inter alia*:—

> "I believe that these Conferences, as some speakers pointed out, do a great deal of good to agriculture generally, apart altogether from the decisions which may be reached. The departmental officers at the discussions of the sub-committees gain the benefit of the experience of other officers engaged in similar services, and use it, no doubt, in carrying out their own duties. It is a privilege to have been associated with officers of the departments at this and previous conferences. . . . Ministers and their staffs are engaged in a great public service in shaping the policy and administering the affairs of the States. When successful, they add to the well being of their fellow citizens and that brings about a recompense which cannot be assessed in terms of cash."

Are we wise? Our abstruse calculations
Are based on experience long;
Are we sanguine? Our high expectations
Are founded on hope that is strong;
Thus we build an air castle that crumbles
And drifts till no traces remain,
And the fool builds again while he grumbles
And the wise one laughs, building again.

—*A. L. Gordon.*

KING ISLAND MELILOT.

(*Melilotus indica.*)

W. M. CARNE, C. A. GARDNER, and A. B. ADAMS.

This plant, also known as Hexham Scent and *Melilotus parviflora,* is an annual clover-like plant 2 to 3 feet in height with small yellow pea-shaped flowers. It may, however, be readily distinguished from the true clovers on account of its flowers being arranged in loose spike-like racemes, and by the strong scent of the plant when cut or crushed.

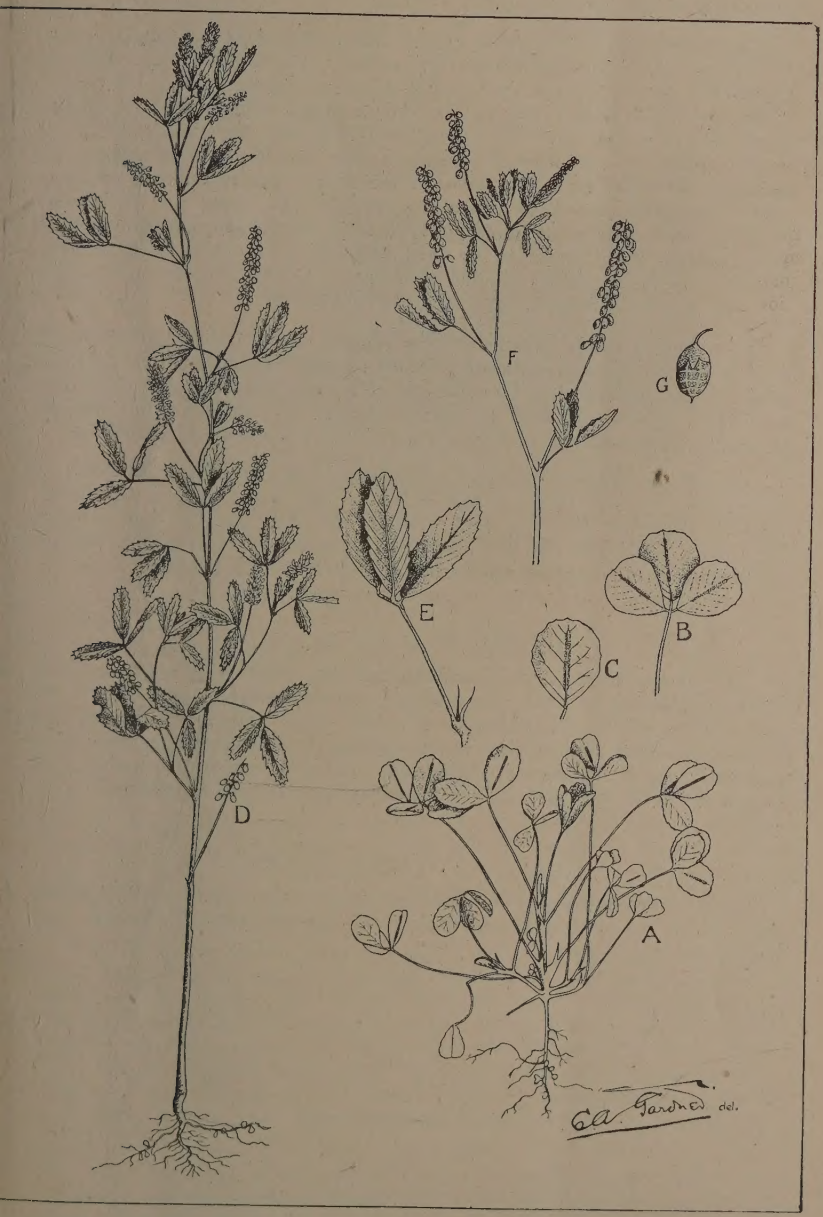
Originating from Southern Asia and the Mediterranean region, the species has spread widely and is naturalised in many countries, especially so in the southern parts of Australia. On King Island, off the coast of Tasmania, the success and reputation it had in converting a sandy waste into pastures famous for fattening cattle earned for it the name of King Island Melilot. The soil there has been so improved by the Melilot that it has been replaced to a large extent by better plants, such as lucerne and cluster clover. Mr. Grasby, of the "Western Mail," states that near Busselton it is known as Nannup weed, and around Mandurah as "Norris's weed," and that in the former locality it is highly esteemed. Melilotus appears to have a special predilection for coastal conditions.

The name Melilotus is from the Greco-Latin, meaning "Honeylotus," and *indica* refers to India, one of its native countries.

King Island Melilot is naturalised in many localities in Western Australia, principally on the coastal plain between Geraldton and Busselton. On the poorer soils it is considered a valuable fodder plant; but where richer soils obtain it is not an unmixed blessing, since it may develop into a weed among more nutritious plants. In cereal crops it is undoubtedly a bad weed, the scent imparting a flavour to the grain. On the poorer soils of the coastal plain Melilotus is quite useful. If established on the lighter sands and gravels, to which classes of soil it is well adapted, it should give profitable pasturage, improving the soil at the same time, and rendering it fit either for cropping or for the growth of a more varied and probably better pasture.

King Island Melilot is only appreciated by stock when they have acquired a taste for it. The plant is then usually in seed when they are forced to eat it by the absence of other feed. The strong scent—which is due to the presence of a large percentage of coumarin—makes it undesirable to stock not familiar with it, and imparts to milk and hay a strong flavour. Many succulent pasture plants cause such flavours, and even lucerne is not exempt. Feed flavours, however, are not very important with milk produced for cream supplied to factories, since under modern conditions of manufacture the cream is pasteurised, and most of the feed flavours are given off in the process.

Two advantages possessed by King Island Melilot are its hardiness—since it will grow in almost any soil—and its value as a soil improver. It has been observed that where clovers were sown on rather poor ironstone rubbly soil in this State the clover plants were altogether better and more vigorous on those portions of the paddock which had previously grown a stand of Melilot.



King Island Melilot (*Melilotus indica*, All.).

In the cold weather Melilot makes only slow growth, developing more vigorously in the spring and early summer.

It is reported that in King Island, where Melilot is extensively grown, the method of establishing it on virgin country is as follows: The trees are ringbarked and killed, the scrub is cut down and burned, and a mixture of Spear grass and Melilot seed is sown on the ashes. The Spear grass makes good growth during the first season, and is grazed but lightly, if at all, leaving sufficient substance to enable a fire to run through during the summer. This fire clears up some of the fallen timber, kills the scrub or timber seedlings that have commenced growth, and prepares the Melilot seed for germination. A similar method is to be recommended for suitable areas in this State: 6-8 lbs. or seed per acre is the usual sowing rate. Superphosphate should be applied at the rate of 1-1½ cwt. per acre, either with the seed or preferably after the first winter rains.

As there is a very high percentage of hard seeds in Melilot, germination is poor unless the seed is treated before sowing. In addition to the bush burn another method is to pour boiling water over the seeds and allow them to soak until cold. If used for surface sowing in a bush paddock without previous cultivation, the seed can be sown before the scrub is burned off.

Mr. B. W. Prowse, of Capel, recommends the sowing of Melilotus on poorer soils near the coast, using 15 lbs. of seed and 1 cwt. of superphosphate to the acre. He states that when in seed the plant has fine fattening properties. It should also give good results on the coast around Geraldton, particularly as there many of the better clovers do not thrive.

DESCRIPTION OF PLANT.

An almost hairless, erect annual, 2-3 feet high, with erect branches. Leaves consisting of three obovate or rounded wedge-shaped leaflets, the uppermost narrow, all toothed. Flowers small, yellow, in long-stalked axillary racemes; stamens nine united and one free; ovary with two ovules; pod sub-globular, somewhat compressed, hard and leathery, drooping, one-seeded, wrinkled with net-like markings, falling off without opening.

EXPLANATION OF PLATE.

A, Young plant showing characteristic marking on leaves; B, A young leaf; C, A young leaflet; D, Plant; E, Mature leaf; F, Branch with fruits; G, Pod.

THE RECLAMATION OF SALT LAND AT "DALIAK."

GEO. L. SUTTON,
Director of Agriculture.

Portion of some land on the banks of a watercourse close to and east of the farm buildings at "Daliak," York, the property of Mr. A. J. Monger, became wholly or partially bare, due to the rise of "salt" near the surface of the soil. The appearance of this land prior to reclamation may be judged from the illustration herewith, which is that of similar country in November last lower down the watercourse.

In order to obtain information regarding the character and amount of the injurious salts present in this soil, a sample of the surface soil was obtained from Mr. A. J. Monger and submitted to the Government Mineralogist and Analyst (Dr. E. S. Simpson) for analysis. The results of this analysis are—

Water Soluble Salts present in a Soil Sample from "Daliak."

Water soluble salts.	Per cent.
Calcium carbonate	0.040
Calcium sulphate	.126
Magnesium sulphate	.140
Magnesium chloride	.043
Sodium chloride	.879
	1.228
Reaction faintly alkaline pH	8.3

The sample is a highly calcareous, fine-textured gray marl.

As soils which contain more than .25 per cent. of sodium chloride—common salt—are considered unsuitable for the growth of farm plants, and this soil contains more than three times that amount, it is obvious that the main, if not the sole, cause of its sterility is due to the presence of excessive amounts of common salt.

From time to time various attempts, including the planting of salt bush, have been made to reclaim this land, and finally considerable success has been achieved. This may be seen from the second illustration herewith, which shows the land formerly sterile now covered with a dense growth of pasture consisting principally of subterranean clover. The land reclaimed is in the foreground, and extends up to and beyond where the sheep are collected. The illustration represents the field as it appeared last November, and after it had been heavily stocked with sheep during the preceding winter and spring.

This gratifying and successful result depicted has been achieved as the result of applying a heavy dressing of stable manure to the land and then later again spreading sheep manure rather thickly over the salty land, cultivating this well into the soil, and then planting subterranean clover with an application of superphosphate at the rate of 1 cwt. per acre. It is believed

Appearance of the land prior to reclamation.

The condition of the land as seen in November, 1926, after reclamation.

that the good results achieved are due to the combined effect of the farmyard manure and the superphosphate. In this connection Professor Paterson has pointed out, "With cereals, superphosphate will help to overcome, for that season, moderate amounts of the salts by specially encouraging the growth of the root system, so that moisture is drawn from a greater depth in the soil. Stable manure assists in combating salts by increasing their absorption, and by its effect in improving the water-holding capacity of the soil."

Further, the addition of the manure obviously dilutes the soil so that the percentage of the injurious salts is reduced in the surface layer of mixed soil and manure. In this particular case also, owing to the calcareous nature of the soil and consequent plentiful supply of lime, the decomposition of the manure is likely to proceed rapidly, and this would so improve the physical condition of the soil as to facilitate the removal of the injurious salt by drainage. This will effect permanent improvement in the only way possible on land containing excessive amounts of soluble salts.

LITHIASIS AND BITTER PIT OF PEARS.

W. M. CARNE, F.L.S.,
Botanist and Plant Pathologist.

LITHIASIS.

The condition referred to appears to be identical with the trouble in pears known as Lithiasis in South Africa (1), and in Continental Europe (2 and 3).

Though the occasional presence of gritty lumps in the pulp just beneath the skin has long been known, this trouble has only recently proved economically serious in this State. Indeed, growers have no accepted name for it. Visibly affected Williams (Bartlett) pears were obtained in 1926 from the

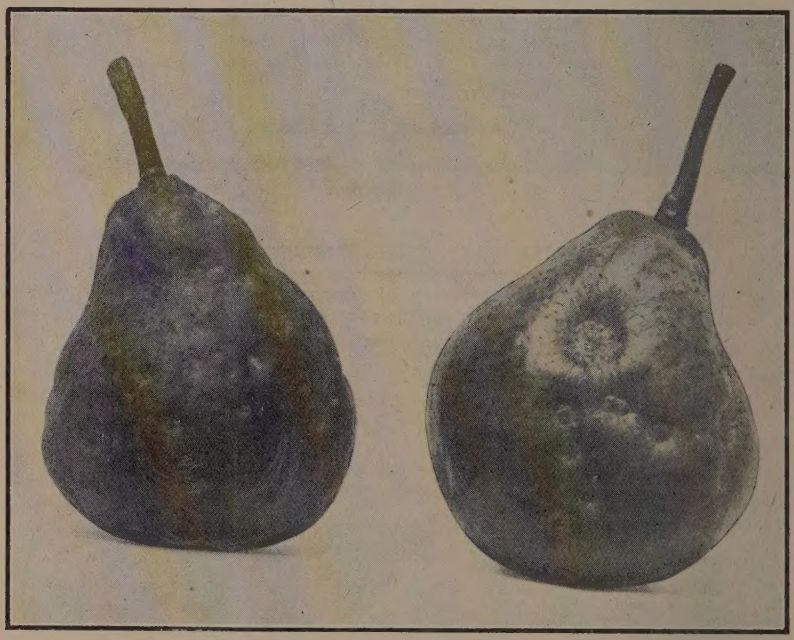


Plate 1.

Lithiasis and Bitter Pit of Pears.

Perth markets, and also from an orchard at Armadale. This year, however, the trouble has been quite frequent in Williams pears at Mt. Barker, Bridgetown, and other pear-growing centres. In most cases the trouble has been only slight, but nevertheless a small variable proportion of affected fruit has had to be culled from good packs. Affected fruits have been common

in the markets, and prices have been affected to some extent. In some orchards a few trees have been affected to such an extent that little of the fruit was fit for marketing.

As found here, Lithiasis is characterised by small rounded gritty lumps in the tissues close beneath the skin. Frequently the skin is ruptured, and rough wart-like eruptions, rarely exceeding one-sixteenth of an inch in diameter, appear on the surface (Plate 2). These are grey in colour, and quite hard and gritty to the touch. The gritty masses in the pulp of the fruit are a faint yellow to light brown when cut, becoming darker on exposure. They consist of groups of cells with walls so thickened as to make them almost solid. These stony cells are normal in pears, but in this trouble they

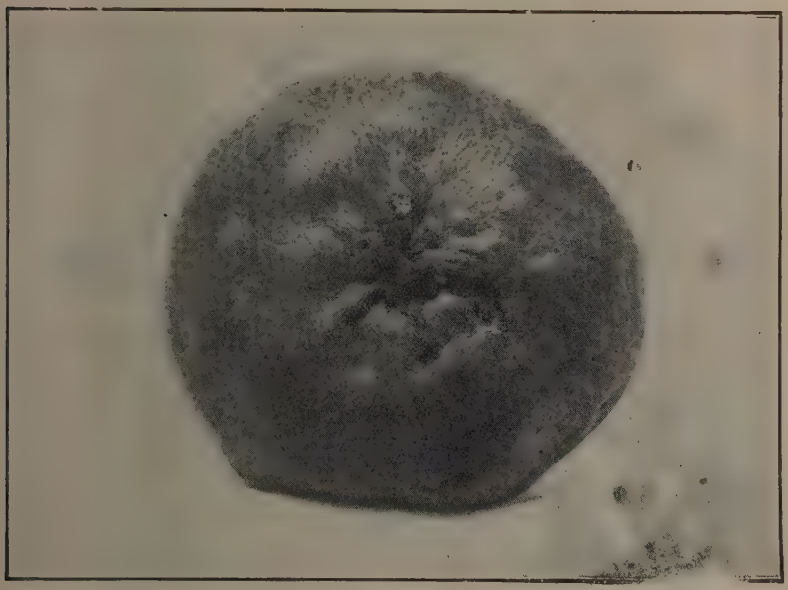


Plate 2.—Williams Pear, showing stony eruptions due to Lithiasis.

are aggregated and persist as hard lumps as the pulp softens with ripening. When the disease is slight the eruptions are usually near the calyx end. In more serious cases they may occupy any position on the fruit—usually more on one side than on the other. The stony masses, except when at the calyx end, are associated with rounded pits in the surface, but the eruptions are not necessarily present in all pits. When the wart-like eruptions are few, the fact that the pear is not normal is indicated by the pitted surface. (Plate 1.) The pits are characteristically shallow and circular, and the areas between are not conspicuously raised.

The trouble, as in South Africa apparently (1), has occurred most severely on the Williams variety. It has, however, been noted this season in a mild form on Vicar of Winkfield, Beurre Clairgeau, Beurre de Capiaumont, Glou Morceau, Winter Nelis and Winter Cole.

BITTER PIT.

Bitter Pit has occurred seriously this season, apparently for the first time in this State. The writer has been unable to find any definite description of this trouble, but the disease found here is identical with that illustrated by McAlpine (4 and 5). He illustrates Pit on Josephine, Beurre Clairgeau, Winter Bartlett and Winter Nelis, and states that it occurs on Broompark (4).

Pit has been found this season occurring severely on Beurre Bosc, Winter Bartlett, and, to a lesser extent, on Josephine.

Externally the disease is indicated by a distortion of the fruit, causing it to be covered with rounded elevations and irregular depressions (Plate 3). In Beurre Bosc the fruit is frequently deformed owing to the greater

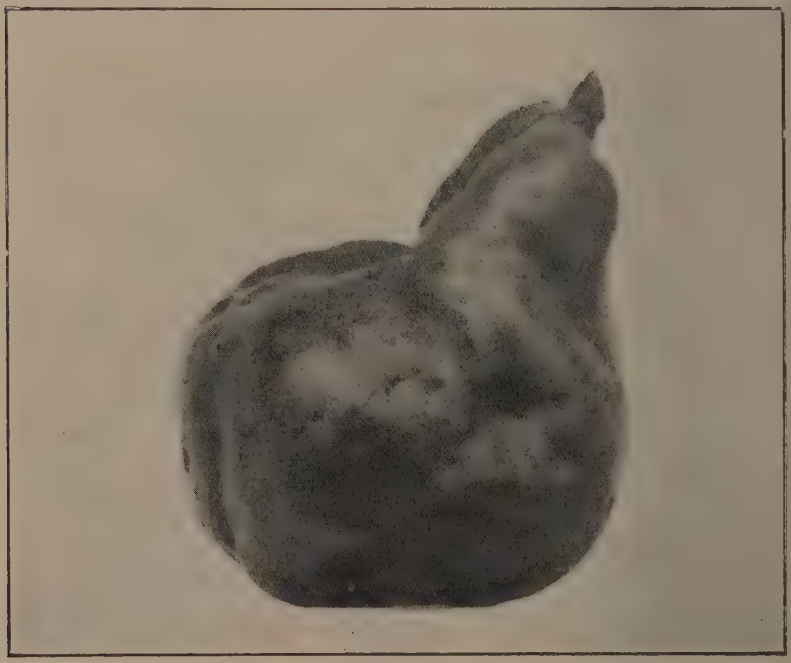


Plate 3.—Beurre Bosc Pear, showing pitting and malformation due to Bitter Pit.

development of the disorder on one side. There is no surface discolouration in the pits. When cut open irregular light to dark brown corky areas are seen (Plate 4). They are up to a quarter of an inch in greatest diameter and may be concentrated near the surface or extend through the fruit even into the core. In appearance they strongly suggest Bitter Pit in apples, differing in the following points:—The affected spots have stony cells in them, making them harder than in apple Pit, though distinctly less gritty

than in Lithiasis; the affected areas extend into the core, which is not usual in apples; there is no surface discolouration; no evident association of starch with the affected tissues, such as occurs in apples, has been noted. The depressions on the fruit are definitely associated with the brown areas. Bitter Pit differs from Lithiasis in that the internal spots are large and irregular, darker in colour, corky rather than gritty, and there are no surface eruptions. The pits are irregular and not rounded as in Lithiasis.

The specimens seen have generally been severely attacked and quite unfit for sale, but what commercial loss has resulted is not known. Three adjoining trees of Beurre Bosc were seen at Mt. Barker on which every fruit was

Plate 4.

Lithiasis and Bitter Pit of Pears.

unmarketable, and the owners stated that these alone were affected. This localisation appears to have been characteristic. As the disease was unknown to growers only severe infections were noted by them. Very little information has been obtainable on either occurrence or severity. It is evident, however, that at least in some varieties of pear the disease may be as bad as Bitter Pit on Cleopatra and other susceptible apples.

It is possible that Bitter Pit in pears is closely allied to Pit and Crinkle in apples. The causes of these latter diseases are, however, still unknown. In the lack of experimental evidence no suggestion is made as to the causes

of Bitter Pit and Lithiasis in pears. At the same time it should be noted that both have appeared to a serious degree for the first time in a year in which Bitter Pit in apples has occurred only to a normal extent.

Bitter Pit has been found to a small extent in quinces this season.

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EXPLANATION OF PLATES.

1.—Lithiasis on Williams (Bartlett) pear, showing pitting of surface.

2.—Lithiasis on Williams (Bartlett) pear, showing stony eruptions.

3.—Bitter Pit on Beurre Bosc, showing pitting and malformation.

4.—Bitter Pit on Winter Bartlett (left) and Beurre Bosc (right), showing brown areas extending into core.

SUDAN GRASS.

That the mixing of superphosphates with Sudan Grass seeds has no ill effects on germination is the conclusion arrived at by Mr. George C. Hodges, of Popanyinning, and he thus gives his experience: Two years ago last October, more seed than required was mixed for sowing, and in the following May, believing the balance of the seed so mixed would be killed, the fertiliser was used to manure some beetroot, with the result that the Sudan Grass came up thickly. Faulty germination of the seed, when this happens, Mr. Hodges believes to be due to three things: 1, Sowing too early. (He never sows before the middle of October and his best crops have been those sown in the last week of that month). 2, Sowing too deep in light soils. 3, Neglecting the use of the "T" bar roller when the crop has been sown.

[Mr. Hodges has been growing Sudan Grass for several years past.—Ed.]

SOIL NITROGEN.

N. Davenport, B.Sc.Agric.,
Agricultural Adviser, Dairy Branch.

Nitrogen is one of those elements of plant food which are essential for growth. If it is present in insufficient quantity for normal growth, then the deficiency will manifest itself in the stunted appearance of the plant combined with an unhealthy yellow or pale green colour. A sufficiency is indicated by the healthy green of the foliage.

Other essential substances such as potash, phosphates, and lime occur in the mineral form and are freed by the chemical and physical actions of natural solvents. Nitrogen, however, must be obtained by its conversion, either as a gas from the atmosphere into a state of solid combination or by the oxidation of humus, by agents in the soil.

These agents are living micro-organisms, and, as a result of their activities, complex nitrogenous substances are formed and deposited to be used later by the plant according to its requirements. As the name indicates, the micro-organisms are extremely small, being seen only with a powerful lens, and occur mainly in the top soil.

The ways by which nitrogen gas from the air is altered to plant food in the soil by the agency of these organisms are:—

(1) Nitrogen fixation through plants of the Legume family, and others of little agricultural importance.

(2) Fixation of free nitrogen from the air.

Fixation per medium of Legumes.—It has long been known that crops of legumes, *e.g.*, clover, lucerne, vetches, etc., leave the soil enriched with available nitrogen instead of impoverished. The explanation of this phenomenon was discovered but a comparatively short time ago, after bacteriology had become firmly established as a science.

Characteristic nodules occurring on the roots of these legumes when examined under the microscope are found to consist of abnormal overgrown tissue inside of which are living bacteria, both normal and modified.

When the plant has become established, the bacteria in the soil, whose property it is to be parasitic on legume roots, attack them and commence to feed on the plant juices, and being aerobic (*i.e.*, requiring air for growth), use the air taken in by the plant by its roots. This parasitism sets up thickening and overgrowth of the affected part. The bacteria themselves live in a surfeit of food, so much so that they become more and more modified, increasing largely in size until a stage is reached when they are unable to resist the digestive action of the plant juices and are themselves used as food. The nitrogenous matter which they have themselves manufactured in their bodies becomes free for use by the plant. There is thus a continuous supply of nitrogenous food obtained by the plant.

On the death of the plant the nodules become disintegrated, the unchanged bacteria are liberated and serve to inoculate succeeding crops of

legumes. Although the bacteria are parasitic, the association is beneficial to both parasite and host. The bacteria live on the juices of the plant, while the latter uses the bacteria as its source of nitrogen for further growth.

As a rule, these root nodules will not form well in sour land, the addition of lime usually having a marked beneficial effect. The increase in the proportion of clovers to total herbage in pasture upon the addition of lime is an example.

Fixation of Nitrogen from the Air.—In 1885, Bertholet showed that nitrogen could be fixed from the air by soil which carried no crop, *i.e.*, the nitrogen content of the uncropped soil increased under suitable conditions. Definite organisms, Azotobacter and Clostridium, being the most important, were isolated from the soil and added to other sterilised material which on analyses, some time later, showed a definite increase in nitrogen. These organisms live on plant food present in the soil and, during respiration, convert a proportion of the nitrogen in the soil atmosphere into nitrogenous substances of their own structure. It is found that the presence of humus which is easily oxidised greatly increases the activity of the organisms, and hence the total amount of nitrogen converted.

There is a third and most generally occurring process by which nitrogen as nitrate is made available to the plant, and this is by the oxidation of humus present in the soil. The process occurs in several definite stages before the final nitrate is formed.

The first is the "Ammonification" stage, whereby the complex nitrogenous substances of the humus are converted into simpler substances of the ammonium type. The specific organism of most importance for this conversion is Bacillus mycoides. Slight alkalinity of the soil gives maximum growth of the bacillus, and hence maximum amounts of ammonium compounds formed. The application of lime would thus probably be beneficial.

The next stage is the oxidation of the ammonium compounds, by the action of "Nitrosomonas," to the nitrite form of nitrogen compounds; the rate of this re-action is comparatively high.

As these nitrites are formed, so are they in turn, by the agency of "nitrate-forming" organisms—of which Nitrobacter is the most important—further oxidised and converted into nitrates, and are then ready for assimilation by the plant.

Of these several stages, the slowest is that of ammonification, so that the availability of any nitrogenous matter is determined by its rate of change into the ammonia form.

There are essential conditions for this process of nitrification to give maximum return.

The living organisms must be able to obtain the necessary elements of plant food such as phosphates, lime, etc., together with sufficient moisture, excess or a deficiency of which will alike hinder the re-action.

Oxygen is necessary for the process which is essentially one of oxidation.

Sufficient base must be present to unite with the nitric acid as it is formed, and so hold it in combination, together with other vegetable acids resulting from the oxidation of the humus.

A suitable temperature is also an all-important factor, 97° F. being found to give the maximum production of nitrates. Thus the temperature of a summer fallow is excellent for nitrate formation. There is very little nitrification at 50° F., as is also the case at 120° F.

Direct sunlight very soon kills organisms in the soil, and, therefore, darkness is another essential factor.

If the nitrates so formed are not used by the plant they may be lost in several ways, the two most important being by leaching and "Denitrification."

Nitrates are very soluble in soil water and are, therefore, easily removed by seepage water; this is essentially a physical action, while the second is essentially a bacteriological one.

Owing to the presence of an organism, "Bacterium denitrificans," under suitable conditions for reduction, the nitrates are reduced to ammonia, oxides of nitrogen, and even nitrogen itself. Excessive amounts of matter which is easily oxidised in the soil would set up reducing conditions, and so lead to further loss of nitrates.

As the nitrifying bacteria are aerobic (*i.e.*, live in air) and the denitrifying bacteria are anaerobic (*i.e.*, live in absence of air), conditions which prevent aeration of the soil will bring about denitrification, *e.g.*, excessive wetness and water-logging with consequent diminution of the soil atmosphere.

The average soils of this State are deficient in nitrogen, but, owing to warm conditions prevailing during the summer, we are able to provide for sufficient nitrogen for a normal winter crop by the process of fallowing.

The Worldly Hope men set their hearts upon
Turns ashes—or it prospers; and anon,
Like snow upon the desert's dusty face
Lighting a little hour or two—is gone.

—*Omar Khayyam.*

FIELD EXPERIMENTS WITH WHEAT AND OATS AT THE MERREDIN EXPERIMENT FARM.

I. THOMAS, Superintendent of Wheat Farms.
J. H. LANGFIELD, Manager, Merredin Experiment Farm.

In addition to the results already published in the March Journal of this year, the following field experiments were conducted at the Merredin Experiment Farm last year:—

With Wheat—

Depth of Ploughing Experiment.
Mulching Experiment.
Fallowing Experiment.

With Oats—

Oat Variety Trial.

The land on which the experiments were conducted was a rich clay loam typical of the Gimlet (*E. salubris*) and Salmon Gum (*E. samonophloia*) forest land. Except where otherwise specified (to suit the requirements of the various experiments) the land was treated in the following manner:—It was ploughed to a depth of four inches with a disc plough during June and July, 1925, cultivated with a springtyne cultivator during September, harrowed after rain in March, and cultivated with a tandem disc cultivator prior to seeding in April.

Though unusually early heavy rains fell in March, and these were followed only by light showers during April, a dry spell succeeded these until the middle of May, and the result was that crops planted during April germinated irregularly, and in some cases malted. Following the rains in May and until the beginning of September the falls were excellent. As a result of the good rainfall and mild weather conditions which also prevailed, the crops made vigorous growth, the foliage being very dense.

During the early part of September no rain fell, and heavy frosts in the mornings with hot drying winds during the day were experienced. The conditions following the mild weather previously experienced affected the crops injuriously, and had it not been for the timely falls during the latter part of September, the results would have been disastrous, but fortunately further late rains were experienced in October with the result that moderately good grain yields were obtained from the early season crops of later maturing varieties, or from the later sowings of earlier varieties.

The monthly rainfall as recorded at the farm for 1926, together with the average for 15 years, is shown hereunder:—

Year.	Jan.	Feb.	Mar.	Apl.	Growing Period.						Total May to Oct.	Nov.	Dec.	Yearly Total.
					May.	June.	July.	Aug.	Sept.	Oct.				
1926 ...	...	26	199	60	91	202	267	94	100	71	825	35	6	1,151
Average 15 years	63	55	77	79	151	172	184	141	92	82	822	37	63	1,176

DEPTH OF PLOUGHING EXPERIMENT.

The object of this experiment, which has been conducted continuously for the past twelve years (commenced 1915), is to determine the comparative effects upon resulting crops of ploughing at different depths. The depths ploughed were:—

Plot 1.—4 inches, representing shallow ploughing.
Plot 2.—6 inches, representing medium ploughing, and
Plot 3.—8 inches, representing deep ploughing.

The plots were each one-eighth of an acre in area, and were repeated eight times, three sections being cut for hay and five harvested for grain.

The plots were ploughed at their respective depths with a disc plough in June, 1925, and cultivated with a springtyne cultivator in September, harrowed after rains in March, and tandem disced prior to seeding on the 19th April.

The variety "Nabawa" was sown at the rate of 45 lbs. of seed per acre and superphosphate (22 per cent.) at the rate of 96 lbs. per acre.

The germination was very uneven, and a little malting occurred.

The results obtained last year, together with the average results for the past 12 years, are given hereunder:—

Hay Yields.

Variety, "Nabawa." Seed, 45 lbs. per acre. Superphosphate, 22 per cent., 96lbs. per acre. Planted 19th April, 1926.

Depth of Ploughing.	Computed yield per acre.			Average, 1926.	Percentage, 1926.	Percentage, 12 years.
	Section 1.	Section 2.	Section 3.			
	C. Q. L.	C. Q. L.	C. Q. L.	C. Q. L.	%	%
4 inches	40 3 20	39 2 0	37 0 0	39 0 16	101	105
6 inches	39 1 12	38 0 16	38 1 12	38 2 16	100	100
8 inches	36 1 20	38 0 0	36 0 0	36 3 4	95	104

Grain Yields.

Depth of Ploughing.	Computed yield per acre.					Average, 1926.	Per-centage, 1926.	Per-centage, 12 years.
	Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.			
	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	%	%
4 inches	17 12	18 48	19 4	22 24	20 16	19 36	101	104
6 inches	17 36	18 0	19 12	22 8	20 16	19 28	100	100
8 inches	19 4	18 0	19 52	20 48	20 24	19 36	101	100

The results obtained last year confirm those of previous years, that there is no advantage gained by ploughing this class of country deeper than four inches. Not only is it more expensive to plough deeper than four inches, but it has also been found much more difficult to work the land down to obtain the desired fine firm seed bed. It is more important to work the land thoroughly than deeply.

MULCHING EXPERIMENT.

The object of this experiment is to determine how far and under what conditions the cultivation of winter fallowed land is profitable during the spring and summer.

The land on which the experiment was conducted was ploughed in June, 1925, to a depth of four inches with a disc plough, and cultivated according to the following scheme:—

Plot 1.—Cultivated during spring, again during summer after a fall of rain of 25 points or over, and again prior to seeding.
Plot 2.—Cultivated during spring and prior to seeding only.
Plot 3.—Cultivated just prior to seeding only.

The plots, which were each one-eighth of an acre in area, were repeated eight times, three sections being cut for hay, and five harvested for grain.

There was a marked difference in the conditions of the seed-bed at the time of planting—Plot 1 was in a very good condition, having been worked down to a fine tilth by the extra cultivations received; this condition was responsible for a good even germination throughout the experiment and resulted in a noticeable absence of weeds, particularly wild oats; Plot 2 was in a fair condition with not such a good tilth and the germination was more uneven; Plot 3 was, on account of the absence of spring and summer cultivation, in a very lumpy condition, and the germination very uneven; there was also a fair amount of weeds, chief of which were wild oats and Barley grass.

The experiment was planted on the 15th April, the variety "Nabawa" being sown at the rate of 45 lbs. per acre, and superphosphate (22 per cent.) at the rate of 96 lbs. per acre.

"Take-all" was fairly evident throughout the trial, but a close examination revealed that the least cultivated plots (No. 3) were the most affected, while the thoroughly cultivated plots were only slightly affected. This observation is important and confirms experience gained in other parts of Australia. The reason seems to be that on the well cultivated plots the Barley grass (*Hordeum murinum*), which is a host of the Take-all fungus (*Ophiobolus graminis*) was destroyed by the frequent cultivations. Moreover, the spring cultivations were, no doubt, also responsible for the destruction of a good many of the spores.

During the early part of September the heavy frosts experienced during the mornings followed by hot drying winds in the afternoons were responsible for "dummy" heads appearing in the plots. No difference could be noticed, however, between the various plots in this regard.

The following table shows the results recorded for 1926, together with the average for 11 years:—

Hay Yields.

Variety, "Nabawah." Seed, 45 lbs. per acre. Superphosphate, 22 per cent., 96 lbs. per acre. Planted 15th April, 1926.

When Mulched.	Computed yield per acre.			Average, 1926.	Percentage, 1926.	Percentage, 11 years.
	Section 1.	Section 2.	Section 3.			
	C. Q. L.	C. Q. L.	C. Q. L.	C. Q. L.	%	%
In Spring, during Summer, and before planting ...	40 2 8	37 2 24	40 2 8	39 2 16	104	104
In Spring and before planting only	38 0 16	36 0 0	39 2 24	37 3 20	100	100
Before planting only ...	32 1 12	33 3 4	35 0 8	33 2 24	89	98

Grain Yields.

When Mulched.	Computed yield per acre.					Average, 1926.	Percentage, 1926.	Percentage, 11 years.
	Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.			
	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	%	%
In Spring, during Summer, and before planting ...	17 44	20 40	17 4	19 4	20 0	18 56	95	103
In Spring and before planting only	20 32	19 52	19 36	19 20	20 8	19 52	100	100
Before planting only ...	21 4	18 48	17 12	18 24	17 44	18 40	94	95

The results obtained this year confirm the conclusions previously arrived at, that the general practice should be to cultivate the fallowed land in spring and again prior to seeding, and that in cases where the ground is weedy this cultivation should be supplemented by additional cultivation after rain during summer. The extra cultivations not only store up additional soil moisture, but also destroy weeds, and assist in the control of the disease "Take-all."

EARLY AND LATE FALLOWING EXPERIMENT.

The object of this experiment is to determine whether early or late fallowing has any effect on the resultant wheat crop on heavy forest land. This is the third year that the experiment has been conducted.

Two plots were used, each half an acre in area, one-eighth of an acre being cut for hay and three-eighths harvested for grain. The early fallowed plot was ploughed four inches deep with a disc plough during the first week in June, 1925. The state of the land at the time of ploughing was good, with the result that the work was done under the most favourable conditions. The late fallowed plot was ploughed during the last week in August, the ground being rather hard and very cloddy after ploughing. Both plots were cultivated with a springtyne cultivator in September, harrowed in April, and tandem disced prior to planting, which took place on the 15th April. Despite the cultivations mentioned the late fallowed plot was not in such good tilth as the early fallowed plot, resulting in a much less vigorous and more uneven germination.

The variety "Nabawa" was sown at the rate of 45 lbs. of seed per acre and superphosphate at the rate of 96 lbs. per acre.

"Take-all" was very bad on the late fallowed plot, and though present also on the other plot, was not nearly so bad.

The following tables show the yield for 1926, together with the average percentage for the past three years:—

Hay Yields.

Variety, "Nabawa." Seed, 45 lbs. per acre. Superphosphate, 96 lbs. per acre.

Date Fallowed.	Computed yield per acre, 1926.	Percentage, 1926.	Average, 3 years.	Percentage, 3 years.
	C. Q. L.	%	C. Q. L.	%
First week in June	39 2 8	100	36 1 12	100
Third week in August	30 3 20	78	29 3 4	82

Grain Yields.

Date Fallowed.	Computed yield per acre, 1926.	Percentage, 1926.	Average, 3 years.	Percentage, 3 years.
	bus. lbs.	%	bus. lbs.	%
First week in June	16 24	100	20 51	100
Third week in August	8 29	52	15 47	76

The results obtained last season, together with the average results for three years, are strongly in favour of the practice of early fallowing. The differences in the yield for both hay and grain are greater than in previous years, and are due to some extent to the prevalence of "Take-all" in the late fallowed plot, thus emphasising the importance of early fallowing.

Some of the advantages of early fallowing are:—

(1) Easier ploughing;
(2) A better chance is afforded for the destruction of weeds;
(3) More moisture is conserved by the longer fallow, thus providing a better insurance against dry spells at critical periods;
(4) Early Fallowing renders it possible to work the soil down to a good tilth, resulting in an even strong germination;
(5) Stimulates the production of nitrates, and sweetens and aerates the soil;
(6) Observations show that Early Fallowing helps to keep down "Take-all."
(7) Increased yields. Over a period of three years the Early Fallowing has given an increased yield of 6 cwts. 2 qrs. 8 lbs. for hay, and 5 bus. 4 lbs. for grain per acre.

EARLY FALLOW. BETTER FALLOW. BETTER YIELDS.

OAT VARIETY TRIAL.

This trial has been conducted during the past four years, and the nine varieties planted in 1925 were again repeated last year.

The land on which the experiment was conducted was typical heavy forest country. It had been ploughed to a depth of four inches with a disc plough in July, 1925, and was cultivated in September, 1925, with a springtyne cultivator, harrowed after rain in March, and cultivated with a tandem disc before seeding. The land was in good condition when the experiment was sown on 30th April, with the result that the germination was very even. The rate of seeding was 37 lbs. per acre, superphosphate being applied at the rate of 96 lbs. per acre.

The variety "Burt's Early" was used as the control, four varieties (grouped in order of maturity to facilitate harvesting) being planted between two controls.

The plots were each one-eighth of an acre in area, and were repeated eight times, three sections being cut for hay, and five harvested for grain.

A dry spell experienced towards the latter part of August and the beginning of September checked all the varieties with the exception of "Mulga," which did not appear to be affected. Heavy winds experienced before harvesting did a considerable amount of damage. The variety most affected was "Fulghum," a new variety being tried for the second time; this was blown flat even before it was ripe, and the low grain yields in all sections emphasise this. In consequence of this defect, "Fulghum" will not

be continued. "Mulga," although rather tall, stood up to these adverse conditions remarkably well. "Burt's Early," although lodging rather badly in places, stood up fairly well on the average, it being somewhat shorter in the straw than some of the other varieties. All the other varieties lodged rather badly, especially "Wilga."

The following tables show the results obtained last season, together with the average results for the past four years:—

Hay Yields.

Planted 30th April, 1926. Seed, 37 lbs. per acre. Superphosphate, 22 per cent., 96 lbs.

Variety.	Computed yield per acre.			Average Yield, 1926.	Percentage Yield, 1926.	Percentage, 1923–26.
	Section 1.	Section 2.	Section 3.			
	C. Q. L.	C. Q. L.	C. Q. L.	C. Q. L.	%	%
Burt's Early (Control) ...	36 1 12	42 0 16	39 2 0	39 1 12	100	100
Mulga	50 2 16	48 2 24	48 2 8	49 1 4	126	116
Guyra	46 3 12	45 1 4	36 3 12	43 0 0	111	110
Glen Innes No. 7	50 0 24	43 3 4	42 1 20	45 2 0	117	*114
Fulghum	32 3 12	37 0 8	37 2 8	35 3 12	93	*96
Burt's Early (Control) ...	38 2 8	40 0 24	36 3 12	38 2 8	100	100
Burt's Early (Control) ...	39 2 0	37 3 12	35 2 16	37 2 16	100	100
Lachlan	44 2 8	39 2 24	35 2 16	40 0 0	107	107
Wilga	38 3 12	36 2 8	33 1 20	36 1 4	98	100
Ruakura	36 0 24	37 1 20	34 1 20	36 0 0	98	96
Algerian	41 0 24	34 0 16	35 0 16	36 3 12	102	99
Burt's Early (Control) ...	33 3 12	36 0 8	37 3 4	35 3 20	100	100

* Average two years 1925 1926.

Grain Yields.

Planted 30th April, 1926. Seed, 37 lbs. per acre. Superphosphate, 22 per cent., 96 lbs.

Variety.	Computed yield per acre.					Average Yield, 1926.	Percentage Yield, 1926.	Percentage Yield, 1923–26.
	Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.			
	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	%	%
Burt's Early (Control)	9 32	19 8	28 24	30 8	32 8	24 0	100	100
Mulga	32 24	38 32	41 8	36 32	37 32	37 16	155	127
Guyra	10 16	10 8	18 32	18 0	25 24	16 24	68	109
Glen Innes No. 7 ...	11 32	9 32	18 24	19 8	20 8	16 0	64	*95
Fulghum	2 8	5 16	2 16	6 16	7 16	4 32	19	*63
Burt's Early (Control)	19 16	17 24	29 32	29 24	30 16	25 16	100	100
Burt's Early (Control)	21 32	24 0	29 0	29 24	28 8	26 24	100	100
Lachlan	11 32	17 8	16 16	16 32	18 16	16 8	60	94
Wilga	7 24	12 16	14 32	16 0	13 8	12 32	48	101
Ruakura	3 16	13 32	21 0	24 16	24 32	17 16	65	113
Algerian	9 16	18 16	17 8	23 32	20 0	17 32	66	109
Burt's Early (Control)	18 16	28 32	28 32	30 8	29 24	27 8	100	100

* Average two years 1925–26.

The varieties which have given the best results during the trial are as follow:—

For Grain—
"Mulga"—127 per cent.—Early.
"Ruakura"—113 per cent.—Late.
"Guyra"—109 per cent.—Midseason.
"Algerian"—109 per cent.—Late.

For Hay—
"Mulga"—116 per cent.—Early.
"Glen Innes No. 7"—114 per cent.—Early.
"Guyra"—110 per cent.—Midseason.
"Lachlan"—107 per cent.—Midseason.

"Mulga" has proved to be a very good dual purpose variety. It matures a little later than "Burt's Early," and is a rapid grower; it appears to be an excellent variety for providing early feed for sheep. The straw is rather coarse, but last season it demonstrated its ability to stand up under very adverse weather conditions, although it is one of the tallest growing varieties we have. The grain is fairly plump, and of a good yellow colour. It seems to be very hardy, and of all the varieties was the least affected by the dry spell experienced during last season.

"Guyra" is a good midseason oat, suited for both hay and grain, and is replacing "Lachlan" to a large extent. The straw is not so coarse as "Lachlan," and the grain has not such a strong awn or "whisker," which has proved so objectionable in the latter variety; it stands fairly well.

"Raukura," a late variety, has yielded better for grain than hay. The grain, however, is of very poor quality, and this variety is rather weak in the straw. Sheep display a great liking for the stubble.

"Algerian," being rather late for this district, does not make very much growth. It has yielded fairly well for grain.

"Glen Innes No. 7" matures about the same time as "Mulga"; it has yielded very well for hay. The straw is rather brittle, and has a tendency to break off after maturity. The grain is awnless, fairly plump, and a dark yellow.

"Lachlan," a midseason variety, has been replaced by "Guyra." This variety has done better for hay than grain. The straw is very coarse, and shows a tendency to lodge, while the grain is very husky and difficult to drill on account of the objectionable awn.

None of the varieties can surpass "Burt's Early" for early green feed for sheep. It is a very rapid grower, and comes away quickly when the sheep have been removed.

"Wilga," although producing grain of good quality, not only sheds very badly, but is also very weak in the straw.

"Fulghum" is a poor yielder, and besides being extremely weak in the straw, is very susceptible to dry spells.

The results of this experiment show that for this class of country, receiving a rainfall of under 12 inches, the best returns are obtained from the midseason to early varieties.

GRAIN SORGHUMS.

W. T. Richardson,
Poultry Adviser.

A mixed plot of Kaffir Corn and Milo grown on Mr. F. McGlew's property at Glen Forrest, on red loam, from seed samples supplied by the Department of Agriculture. No cultivation, irrigation or attention of any kind was given to the above plot after the seed was sown.

Kaffir Corn and Milo.

The plants are hardy and the heavy yields obtained in this State, under diverse soil conditions, should stimulate the cultivation of these valuable fodder and grain sorghums.

Maize is obtainable only at high prices, which seriously affect its use as a poultry grain. There is no reason why grain sorghum should not take the

place of maize in our poultry rations. A demand for such a substitute exists and poultry farmers would welcome the opportunity of a much needed addition to the diet of their birds.

Grain Sorghum.

Grain sorghums are nearly equal to maize in feeding value, as shown by the following table of analyses—

Maize (Grain)—10.50 per cent. Protein; 8.0 per cent. Fats, Oils, etc.; 66.5 per cent. Carbohydrates; 1.50 per cent. Salts, Minerals, etc.; 2.50 per cent. Fibre; 11.0 per cent. Water.

Sorghum (Grain)—9.0 per cent. Protein; 3.8 per cent. Fats, Oils, etc.; 70.1 per cent. Carbohydrates; 2.0 per cent. Salts, Minerals, etc.; 3.6 per cent. Fibre; 11.5 per cent. Water.

'Tis all a chequer board of Nights and Days
Where destiny with men for pieces plays,
Hither and thither moves, and mates, and slays,
And one by one back in the cupboard lays.

--Omar Khayyam.

COUCH GRASS.

(*Cynodon dactylon.*)

W. M. Carne, A. B. Adams, and C. A. Gardner.

Couch Grass is a cosmopolitan species. In India, it is well known under the name of Doub grass, and, according to Shaw, is the same as the Durva grass, sacred to the Hindoos, the absence of which caused death in cattle. It is also the Bermuda grass of America and the West Indies. The Couch or Twitch grass of Britain (*Agropyrum repens*), is quite distinct and is not common in this State. The name Cynodon is from the Greek Kynodon, meaning a dog's tooth, and dactylon, from daktylos, is in allusion to the finger-like form of the inflorescence.

Of all the true grasses, Couch grass is probably the most useful and permanent pasture plant for the lighter soils in the coastal parts of the South-West. Where the conditions are suitable for Paspalum, Couch grass is inferior to this species, but Couch can adapt itself to drier conditions, and hence will provide useful pasturage where Paspalum is unable to thrive.

Couch grass is sometimes stated to be of low feeding value, usually because it is growing in poor or rundown soil, its feeding value being directly related to the soil in which it grows. If there are other plants allowed to grow with the Couch, and these make but poor growth during the winter when the Couch is dormant, the soil is usually impoverished and requires top-dressing with superphosphate. If the soil is good, or has been fertilised, there will usually be a good growth of clover during the winter. Since Couch is principally a summer-growing grass, making but little growth in the cold weather, the clover lengthens the grazing period. Clovers and Couch are mutually helpful, the clover adding nitrogen to the soil, while the Couch provides shelter for the young plants, the seeds of which germinate in the autumn. Soils which are suitable for Couch grass are usually suited to the annual clovers. In damper soils, White Dutch clover will grow with Couch, but such soils would give better returns with Paspalum.

Couch grass proves troublesome in orchards, gardens and on land required for summer crops, especially lucerne, owing to difficulties experienced in its eradication. The underground creeping stems require to be completely removed, otherwise the smallest pieces of these will grow again. Digging the grass in is useless. On land other than that under constant, or summer cultivation, the grass should be encouraged as it interferes but little with winter cropping, and gives useful green feed in the summer, when most other plants are dry. Cultivation during hot, dry weather, raking up the stems and burning are the best means of eradicating Couch from arable land.

Couch grass may be established by root planting. After the soil has been prepared, furrows about 6in. to 1 foot apart should be made, and in these pieces of the plant should be dropped about every eighteen inches. These should be covered either by hand, or by means of a plough. Spring is the best time for sowing, so that the plants may become well established before the approach of the dry weather. In Western Australia, Couch is seldom grown from purchased seed, although, when once established, the

Couch Grass (*Cynodon dactylon*, Rich.).

plants are spread more through the agency of stock eating the seeds than by the spreading growth of the plants themselves. Unlike many pasture plants, an occasional ploughing helps to spread it, the underground stems being cut up and distributed, thus forming new centres of growth.

According to the soil in which it grows, Couch grass varies in texture and quality. In alluvial soils, the grass is fine and dense and has a much greater carrying capacity than that grown on sandy soils.

For lawns, Couch grass is much used, and is sometimes grown from seed, although planting sods of turf gives better and quicker results. For proper maintenance, the lawn should be kept free from weeds, occasionally top-dressing with sand, and kept well cut. A suitable fertiliser would be a mixture of 2½ parts of superphosphate and 1 part sulphate of ammonia, mixed as required and used at the rate of 2ozs. per square yard, about three or four times a year. When the grass is used for tennis lawns or bowling greens, the same mixture may be used monthly at the rate of 2/3 oz. to one ounce per square yard in preference to the more occasional heavier dressings. Care should be taken to broadcast the fertiliser evenly. This is best done by using one-half up and down the lawn, the other half being applied at right angles to the first. Repeated dressings are more necessary on sand than on heavier soils, owing to the leaching effects of repeated watering.

Couch grass appears to have several forms which differ in the relative coarseness of their runners. The finer forms should be the better for lawns.

DESCRIPTION OF PLANT.

A perennial grass with numerous creeping, usually underground, stems, rooting at short intervals, and spreading to as much as eight feet in length, the flowering branches ascending and forming leafy shoots. Leaves short, usually of a bluish-green. Spikes two to five, often purplish, on slender stalks, usually four—10 inches high, the spikes radiating from a common base at the top of the main stalk. Spikelets sessile, one-flowered, sessile in two ranks on one side of the slender rhachis. Outer glums two, narrow, acute and persistent, keeled, less than one-twelfth of an inch long. Flowering glume boat-shaped and keeled without an awn, larger than the outer glumes.

For details of habit, see plate.

No game was ever yet worth a rap for a rational man to play,
Into which no accident, no mishap, could possibly find a way.

—*A. L. Gordon.*

POULTRY HOUSING.

W. T. RICHARDSON,
Poultry Adviser.

Semi intensive poultry shed at the Falls Poultry Farm (E. and K. Sudlow), Walliston, built from plans supplied by the Department of Agriculture, details of which appeared in the "Journal" of December, 1926. (See Figs. 1, 2, and 3.)

Fig. 12.

Fig. 12—Front view of portion of shed, the dimensions of which are: depth 14 feet, length 88 feet, with a G.C. iron division in the centre. This shed will house 400 laying hens (200 in each section). A similar shed is now under construction.

Fig. 13.—Interior of one end of the shed.

Note—(1) Perches 24 inches apart.

(2) 12in. board along the front of the perches to prevent litter being scattered under the roosting space.

(3) Opening along the top of back wall for ventilation purposes.

(4) Window at back of house for use in hot weather.

(5) The front of the shed is netted in.

Cost of material for whole shed, including concrete floor, £67 5s. 4d., or 3s. 4¼ per bird.

HORTICULTURAL AND VITICULTURAL NOTES.

Geo. W. Wickens,
Superintendent of Horticulture.

SEASONAL WORK FOR JULY, AUGUST AND SEPTEMBER.

July.

Growers of apples, pears and stone fruits will find most of their time occupied this month in pruning, and, as I have before stated in the *Journal*, so far as fruit trees are concerned, there are nearly as many styles of pruning as there are operators, each exponent claiming some special benefit accruing from the procedure he follows. It is certainly a fact that, provided soil and climatic conditions are suitable, fruit trees will produce crops of fruit under the most varied methods of training, and with little or no training at all, but there are certain fundamental principles underlying pruning which should be mastered by the beginner, and having grasped these and acquired the habit of closely observing results from year to year, he will find he is able to train his trees satisfactorily and obtain good crops even though his style differs somewhat from orthodox methods. To obtain success, every grower should have a definite system in view and follow it This does not, of course, mean that he should perform all the work himself; that would be impossible in some of the large orchards, but he should be able to tell his employees how he wishes the trees to be pruned, and see they are done in that way, for although there are many styles giving good results, sudden variations from year to year, when different pruners with divergent views carry on the work, are decidedly bad for the trees and costly to the owner.

To prune for profit is the object to keep in view, and to achieve this, each tree must be treated in such a way that it will produce a maximum quantity of fruit of good quality and marketable size. Leaders must be

spaced so as to allow light and air to penetrate freely to every part of the plant, while guarding against over-exposure, which results in sun-burned bark and fruit. In the tree's earlier years care must be taken by moderately hard pruning to force growths from buds all along each leader's length and avoid bare spaces so often noticeable, but so unsightly and unprofitable; while in later years, equal care must be taken in guarding against over-crowding of bearing buds and shoots which may produce many fruits, few of which are of good quality or marketable size.

There are many who have embarked in the industry with little or no knowledge of the habits of the trees from which they hope to derive a livelihood, and these are strongly advised to get in touch with the Orchard Inspector, who supervises their particular district and request him to give a practical demonstration on their own trees, illustrating the best way to prune them. The Inspectors have had long experience in this work and know the habits of the trees under the conditions obtaining in the various fruitgrowing portions of the State, and a beginner will learn more in a couple of hours from seeing the work done and having an explanation of why it is done than he will from a week's study of a text-book. As he gains in experience, he will find that a good text-book is a very valuable aid, but a complete novice finds it hard to recognise from the description given on the printed page the various buds and growths on the actual trees.

Planting deciduous trees should be pushed on with during this month. If the land is too wet for planting operations when the trees arrive from the nursery, every care must be taken to heel them in in moist (not wet) soil to prevent the roots drying out.

Trapping should be continued in all orange groves where fruit flies were known to have been present during the past summer.

Oranges and mandarins should be watched carefully for signs of the pest and all fruit found to be infested should be boiled.

August.

Pruning and planting deciduous trees and vines should be completed by the end of this month, and wherever the soil is dry enough, spring ploughing should be in full swing. The second winter spraying for San José Scale should be completed before the 31st on all trees where the buds are forward. Late blooming kinds, like Rome Beauty and Five Crown apples, may be left until the middle of September.

Where old apple and pear trees require working over to other varieties, the necessary scions should be secured early in this month from trees thoroughly dormant, and buried in soil in a cool place to retard bursting of the buds.

Orange Aphis will appear about the end of this month, and where the insects are sufficiently numerous to damage the young shoots, they should be sprayed with Black Leaf 40 and soap, using 1lb. Black Leaf 40 and 3lbs. soap in 80 gallons of water.

Where San José Scale and Woolly Aphis require treatment in the same orchard, use Black Leaf 40 and Lime Sulphur as advised in notes for May in the previous issue of the *Journal*.

Continue the search for, and destruction of, citrus fruits infected with fruit fly, and carefully examine ripening loquats for traces of the pest, also continue trapping.

September.

The first ploughing should be finished early this month and the cultivators brought into use. No grower can afford to risk putting off cultivation in the expectation of good rains falling in the late spring. Dry winters are practically unknown in the fruit-growing areas of Western Australia, and provided the land is kept in a thoroughly tilled condition during spring and summer, sufficient moisture can be conserved in the soil to enable the fruit to attain good size and quality, but where cultivation is neglected, the fruit is undersized, lacking in juice and poor in appearance.

Spray during pinking stage to control Pear Scab (*Venturia pirina.*)

Continue spraying, where necessary, for Orange Aphis.

Continue trapping for fruit flies and commence baiting as soon as the various fruits become sufficiently ripe to serve as a depository for the eggs of the pest.

Planting of citrus trees should be completed this month.

Graft over old, obsolete varieties of pear and apple trees to varieties which will pay for their upkeep in the orchard, but only do this if the stocks are sound and healthy; an unthrifty stock will never result in a good tree, no matter how well the grafting is done. Use the strap graft, and if not familiar with it, ask the Orchard Inspector in your district for a demonstration.

ARMY WORMS, CUT WORMS, AND WEB WORMS.

L. J. Newman, F.E.S.,
Entomologist.

The war against Army Worms, Cut Worms, and Web Worms is essentially a war against weeds and dirty stubble. The cleaner the land to be cropped, no matter what the crop is to be, the less the farmer will suffer from the abovementioned pests. In other words, farm sanitation is one of the most important things in our fight against insect pests.

Insect pests may be divided roughly into three groups, viz.:—

1. Insects having a single host plant.
2. Insects having several host plants.
3. Insects which are omnivorous, that is, they feed upon animal or vegetable foods.

1. Insects having but one host plant are rare.

2. The majority of insect pests of crops possess two or several host plants, generally closely related botanically.

3. Cut worms, army worms and locusts are good examples of omnivorous feeders. Although they have preferences for various plants, they are capable of feeding upon almost anything.

It is because of this fact that I lay so much stress on the need of farm cleanliness if we hope to cope with them. We have never experienced an outbreak of caterpillars in a crop that has been sown on clean, weed-free fallow. What has frequently been observed is the invasion of a fallow crop by army worms which have originated in a dirty stubble or grassy paddock in close proximity. Fallow, fallow—it has to be repeated—is the greatest insurance against insect pests other than migrating forms.

The moths from which the following swarms of caterpillars have their birth fly soon after the first autumn rains. These moths emerge from chrysalids which have hibernated throughout the summer. The species of cut worms and web worms from which we mostly suffer, in our inland country, fortunately have only one generation per annum. They pass the winter and early spring in the larval or caterpillar stages, doing their maximum damage in August and September. The moths belonging to this group infest only those fields which present a growth of vegetation or other conditions favourable for egg laying in the autumn, when the moths are flying, the main period of flight extending over a period of about three weeks.

Naturally, when on flight the parent moths instinctively turn their attention to grassy, weedy land or stubble, where they lay or deposit their hundreds of eggs upon leaves, old wheat, stubble, and other rubbish. It is, therefore, obvious that if the land to be cropped is free from weeds and rubbish the moths will pass over to some place where a prospect for food for their young does exist.

In our moister south-west and coastal country the common cut worm (*Agrotis munda*) and the web worm (*Sclerobia tritialis*) are to be found all the year round. The main damaging swarm is, however, in the spring, later generations being more or less controlled by numerous parasites and unfavourable climatic conditions.

In my investigations I have found the most destructive and common species throughout the wheat areas and the South-West to be the army worm (*Persectania ewingi*), cut worm (*Agrotis munda*), and what is locally termed the web worm (*Selerobia tritialis*).

Some seasons the Bugong Moth (*Agrotis infusa*) is numerous, but is not a frequently recurring serious pest.

There are several other moths belonging to the Noctuidae, such as the Climbing Cut Worm (*Chlorodea obsoleta*), and the various plusia, which will be dealt with in a separate article.

The army worm (*Persectania ewingi*). This belongs to the family Noctuidæ, and is the most common wheat and crop pest in the inland area.

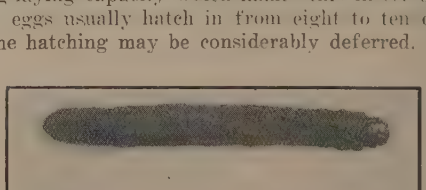
Army-worm Moth (*Persectania ewingi*)—
1. Moth with wings outstretched.
2. Moth at rest.

(Original.)

The moth is a pale slate-coloured insect marked with short parallel lines of a darker tint in the centre and towards the tips of the fore wings. The thorax is of much the same colour. The hind wings and abdomen are a dull fawn colour. The measurement of wings when outstretched would be from 1½ to 1¾ inches. Body short and thick-set. Nocturnal or night flying.

Eggs. These are in actual size about as broad as a pinhead, and may be deposited in a patch on a leaf or in grass, weedy or stubble land.

Several hundreds of eggs may be laid by a single female moth. It is this enormous egg-laying capacity which makes this insect of such economic importance. The eggs usually hatch in from eight to ten days, but if cold weather sets in the hatching may be considerably deferred.



Larvae of Army-worm (*Persectania ewingii*).

(Orig.)

When full grown, the larvæ vary from 1½ to 2 inches long. Colour variable, but chiefly of a dull olive-green with light stripes down the back and sides. When touched they have the typical noctuid caterpillar habit of curling up and shamming death. When not feeding, they lie hidden under clods of earth or other suitable shelter.

These caterpillars always break out on dirty, weedy grass lands or on an old stubble paddock. When hatched from the egg they are very tiny, and at first appear to do little damage. After the second moult their appetities rapidly increase and their powers of destruction become very great.

It is not long before the supply of food at hand gives out, and it is at this juncture they assume the travelling or army formation. Being starved, they have to go in search of food and hence migrate to food nearest at hand. Should a crop be in their line of march, it is rapidly invaded by the hungry, ravenous hordes of caterpillars, their presence in the crop being very soon made apparent.

In some instances, however, these army worms break out in a growing crop. This only happens when grassy, weedy or stubble land has been turned in and cropped after the moth flight. Naturally these lands have attracted the parent moths and myriads of eggs have been deposited thereon.

Such land is usually turned in late. The eggs and weeds are ploughed under and covered with soil. The crop is sown, and grows. Later a patchy appearance will be noticed. These patches, upon examination, reveal the presence of numerous young army worms, the resultant young from the eggs turned in before sowing, the young caterpillars having worked their way to the surface and feeding upon the wheat plants.

Crop destroyed by the Army-worm (*Persectania ewingii*).

(Orig.)

It does not follow that these caterpillars always appear under these conditions, or that all patchiness observed in crops is due to their presence. In years when these insects are in plague form it will always be found that the outbreaks in crops occur under these conditions of dirty, late sowing. This particular caterpillar shows a strong preference for wheat, and will often not touch oats.

Pupæ. When full grown the caterpillars seek any cover, such as clods of earth, under stones, logs and rubbish, and in many instances bore into the soil and there pupate.

Naked pupae of Army-worm.
(Orig.)

The caterpillars generally form cell-like structures in the soil, or under the object sheltering them. As before stated, this army worm is single brooded, in the inland wheat areas the pupæ formed in September remaining dormant until the following autumn rains. This caterpillar is not a serious pest of the coastal or more southern wet areas.

Clod of earth, showing Army-worm forming cell prior to pupation, also two pupae of moth and one cocoon of parasite.
(Orig.)

Web Worm (*Sclerobia tritialis*). Family Phycitidæ.

In habits this is also a nocturnal insect, both moths and larvæ coming out at night.

Moth. A small inconspicuous species which, when at rest with wings closely folded around body, is not easily seen. The colours of the moths harmonise with the dry stems of wheat and grass. The fore wings or front wings and the anterior or hind wings are generally of the same colour. Some specimens exhibit a slightly darker fore wing. From tip to tip of outspread wing measures one inch. The thorax and abdomen are thin and of the same colour as the wings.

Web-worm Moth (*Sclerobia Tritialis*).
Enlarged. (Orig.)

Eggs. These are tiny round pale yellow bodies, and are laid amongst grass. The eggs hatch in a few days, or may be held back by cold frosty weather.

Larvæ or Caterpillars. Dark green to black colour. Length seldom exceeding ¾ inch.

Larvae of Web-worm.
Enlarged. (Orig.)

These caterpillars are usually found in grass lands, and in a plague season cause considerable loss to crops. They are also very troublesome to couch lawns.

The moths fly during April and May, and deposit their eggs in grass.

Native Grass, *Triticum* (*Agropyron*) *repens*. Natural food of the Web-worm.

(Orig.)

These hatch into small caterpillars which at once begin to construct silken tubes amongst the mat of grass, or if infesting a crop, they form tubes in the soil at the base of each stool.

The presence and numbers of this pest in an area are usually in proportion to the length of time that a field has been under grass before being ploughed and sown.

The caterpillars live within their tubes during the day and come out at night to feed. They cut off and draw the food into their tunnels and there

Native Grass cut down and destroyed by the Web-worm (*Sclerobia Tritialis*). Note the entrance holes to the silk-lined tunnels in which the caterpillars reside. (Orig.)

consume it. Unfortunately a great deal is cut down and destroyed that is not eaten, but is left on the ground to dry up.

This caterpillar does not migrate in armies, but takes a crop of grass or wheat on a face.

It is troublesome to crops only when it outbreaks in the crop. This is never the case when crops are grown on fallow or the land has been broken

up prior to the end of April. It is always in crops grown on land carrying grass and turned in late, after the young grass has appeared, that the trouble from this pest is suffered.

The eggs had already been laid amongst the old dry grass or young grass. These, when turned in, hatch, the young caterpillars working their way through the loose soil to the surface. Here they establish themselves and feed upon the wheat plants.

As they demolish one stool they move on to the next. Unfortunately there is very little second growth once this pest has been over a crop. This is due to the fact that the wheat plants are eaten down below the crown. Several caterpillars may be found in a single wheat stool.

Pupæ. When fully grown the caterpillars pupate within their silken-lined tubes. Like the army worm, this pest, in the inland areas, appears to have only one damaging brood. In the moist coastal districts, and where artificial water is applied, the larvæ of this moth can always be found. The August-September generation is, however, the generally destructive one.

Cut Worm (*Agrotis Munda*). *Family Noctuidæ.*

Moths. They are of the typical noctuid form. The average measurement from tip to tip of outstretched wings is 1½ inches.

Colour. Fore wings pale brown mottled with darker brown and grey. Hind pair very light fawn with darker shadings towards the outer edges and bordered with a fringe of fine light hairs.

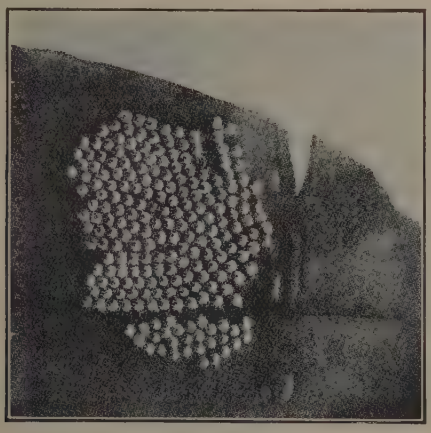
Common Cut-worm Moth (*Agrotis munda*), depicting larvae, pupa, and adult.

Eggs. These are small white objects and are laid sometimes singly or in clusters on bark, amongst weeds and rubbish, or direct on to the soil at the base of the plant attacked. The eggs hatch in from six to eight days.

Larvæ or caterpillars. Thick, fleshy, and tough. Colour ranging from dirty sandy-brown to a murky green, and showing very faint lines along the back and sides. Body almost hairless. These caterpillars are strictly night feeders. During the day they remain hidden in the ground at base of plant or other suitable shelter.

When touched they curl up and feign death.

Pupæ. These are pale brown with a small spine at the posterior end. This stage is generally found in the same situation as the larvæ, usually (but not always) enclosed in a small cocoon covered with particles of soil.



Egg mass of Cut-worm Moth.
(Orig.)

There are several generations of this insect during the year, the two most damaging periods being spring and autumn.

Parasites.

Fortunately there are many beneficial insects which prey upon these caterpillars. If it were not for these natural aids it would be well nigh impossible artificially to control many of our pests. Even with the great

Parasitic Fly, species of *Tachinidae*, parasitic on Cut-worms.
(Orig.)

army of friendly insects on our side there come seasons when the pest for a time gains the ascendency.

These insect friends are of two classes—parasitic and predaceous.

The true parasites are those insects which lay their eggs on to or into their host victims. The resultant larvæ, feeding upon the internal body juices and finally attacking the vital organs, cause the ultimate death of the host.

The predators are those insects which seize their victims and devour them. Birds are also great predators. Amongst other beneficial insects observed as parasitic upon caterpillars was a species of Tachinid Fly.

This fly deposits its eggs on the body of the caterpillars. The resultant maggots, boring their way into the internal organs, cause the death of the caterpillar. Instead of a moth issuing eventually, a number of Tachinid flies take its place. These flies are robust in appearance and always bristly, their sharp spiny points projecting in every direction.

Parasitic Wasp, Species of Ophion.
Natural enemy of Army-worm.

(Orig.)

Another parasite very active amongst the caterpillars was a species of Ichneumon wasp belonging to the genus Ophion. It is a typical reddish-

Larva of parasite leaving the body of its host victim.

(Orig.)

brown insect, about three-quarters of an inch body length, clear wings, and curiously curved and laterally flattened body, being broadest at the extremity. It possesses powerful legs, and can be seen seizing and stinging its victims.

An egg is deposited in the body of the caterpillar, which gives rise to a legless maggot. This larva feeds upon the body fats of its host until nearly full grown. It finally attacks and destroys the caterpillar, leaving but the empty skin (see p. 236).

Pupal cases of Ophion parasite.

(Orig.)

Prevention and Control.

A general life-history of the three caterpillars has been given. A knowledge of the life-history and habits of an insect is necessary in order to tell at what period in its life it can be most readily destroyed.

The most important points to obesrve in the control of insect pests are—

1. Prevention as far as possible.
2. Strict attention to details in the preparations of the remedies employed.
3. Thoroughness and timeliness of application.

Preventive measures are usually the cheapest and the most easily accomplished. They are, first, clean culture; that is to say, not allowing rubbish and weeds to accumulate. Knowing definitely that the parent moths of these caterpillars will only deposit their eggs on or amongst weeds, grass or stubble, the most successful preventive method is to crop on fallow. Land kept free from weeds and grass will never be infested. If not possible to crop wholly on fallow, plough and turn in the stubble or grass lands as early as possible in the autumn, thus doing away with the natural attractions before the moths issue in later April. If stubble is not fed off with sheep or ploughed well under, it should be burned.

Keep new season's crop as far as possible from area cropped the previous year. Never turn in late in May or June grassy lands and crop same. Keep the headlands free from weeds and rubbish.

If growing oats, use them as buffer crops, growing them around the wheat crop. The migrating caterpillars are repelled when they come upon the oats.

Examine crops at regular intervals, and when patchiness is noticed, investigate the cause. Look under clods, etc., and if caterpillars are found, take prompt action.

Remedial Measures. If caterpillars have broken out in crop (which, as before emphasised, is due to dirty farming), the first act should be to cut ditches. A combination of ditches and poison bait may be used to good advantage against travelling caterpillars. Whether army worm or web worm, this method is successful.

The ditches or trenches employed are of two kinds—the vertical-sided ditch for moist soil or holding soil, and the dusty or loose-sided trench for dry or sandy soils.

The furrow should be thrown away from the field to be protected, that is, the opposite way to that in which the caterpillars are travelling. It may be necessary in order to get an effective trench, to run the plough through a second time. A coulter should be used in order that the edge of the furrow may be as sharp as possible.

In some parts of the ditch it may be necessary to shape up with a spade. Along the trenches, at intervals of 30 to 40 feet, sink pot holes. The caterpillars in roaming up and down the trenches fall into these holes and may there be destroyed per medium of a ramrod.

Too much labour and time should not be expended on the trenches. The main purpose is to halt the advancing army so that they will be induced to feed upon poisoned bait scattered along the furrows. Marching caterpillars, if not so halted, will sometimes pass over bait without feeding. In case many caterpillars succeed in crossing the first barrier, a second trench some distance beyond should be ploughed.

Poison Bait. Having put in the checking barriers, poison baiting should at once be resorted to. The formula recommended is simple and effective, made up of the following ingredients:—

Bran, 30 lbs.; Paris Green or Arsenite of Soda, 1 lb.; Molasses, 4 lbs. If using White Arsenic powder, add 2 lbs.

In preparing this mash, mix the bran and poison powder together thoroughly in dry form. Dissolve the molasses in water and wet the bran and poison until of the consistency of a crumbling mash.

This mixture should be applied as soon as the caterpillars are noted. It is important, too, that the mixture be scattered after sundown, or as late in the afternoon as possible, so that it will be moist and tempting when the pests come out at night to feed.

This mixture is very attractive to them when they crawl about in search of food, and they will actually take it in preference to the growing vegetation. If put out in the heat of the day the bait dries rapidly and is not nearly so attractive.

The bait is broadcasted amongst the caterpillars and in the trenches. Spread bait as thinly as possible, avoiding wet lumps. Thirty pounds of mixture should be sufficient for one acre.

For the common cut worm in gardens, which lives at the base of the plant attacked, the bait should be placed in a ring around each plant or along each side of a row of plants. Do not permit bait so placed to come in contact with stem of plant, as there is serious danger of burning and injury. Sodium Fluoride has recently been experimented with as cut-worm poison, and has proved very effective. It is used at the same rate as Paris Green, namely, 1 lb. to 30 lbs. of bran.

If caterpillars still persist, it will be necessary to make a second and perhaps a third application of the bait at intervals of three to five days, according to weather.

Poisoned vegetation is sometimes used in place of bran. The cost of this method is greater and is therefore not recommended except in very small areas. In preparing the green bait the plants should be chopped up and

piled on a clean surface, moistened with the molasses water, and turned as the poison is dusted over them. This material is then loaded and distributed over the field in small bunches or along the rows of plants to be protected.

A simple formula for small gardens is one quart of bran, one teaspoonful of paris green, and one tablespoonful of molasses, with sufficient water to moisten to a crumbling mash.

Note. In the mixing of bait, it is necessary to take precautions against inhaling any of the poison dusts. All utensils used in making must be thoroughly washed. Keep all animals from access to bait. After broadcasting thoroughly wash hands and face.

Spraying. Paste arsenate of lead 3 lbs. to 40 gallons, or if using dry form, 1½ lbs. is effective.

Rolling. When the army worms are observed to be travelling over smooth, hard surfaces such as roads, etc., large numbers may be destroyed by heavy rollers.

In conclusion, I would point out that the secret of success against these pests depends largely upon making oneself acquainted with the habits and times of appearance, and to have a working knowledge of the preventive and control practices.

Frequently serious damage has been done to a crop before the owner has made himself aware of the presence of the caterpillars.

The old adage, "a stitch in time saves nine," is most applicable when dealing with insects.

BROOM MILLET COMPETITION.

G. K. BARON-HAY, B.Sc. (Agric.).
Assistant Superintendent of Dairying.

As a result of the promising returns obtained by farmers from the seed of this crop, which was distributed by the Department for the season 1925-26, it was confidently believed that all the millet fibre for the brush-making industry in this State, could be grown here.

A further distribution of seed was, therefore, made last spring to farmers throughout the State, who expressed a willingness to plant a trial plot.

In order to encourage the cultivation of broom millet, the W.A. Brushware Company, Fremantle, generously donated a prize of £5, to be awarded to the grower of the best 1 cwt. of fibre received at their factory this season. The company further guaranteed to purchase all fibre produced in the State this season at the market price ruling when the fibre was received at the factory.

I.—Broom Millet grown by Mr. W. J. Clarke, Group 93, Denmark.

Entries closed on the 30th April, the original date being extended a month to allow farmers on the semi-swamp land around Bengen and Yarloop to compete, as it is not possible to plant before December on much of this land.

The judging was carried out at the Brushware Factory by the manager, Mr. P. F. C. Anderson, and the writer, the following being the results:—

——	Quality of Fibre. 10.	Colour of Fibre. 10.	Freedom from Seeds. 10.	Length of Stalks. 5.	Packing. 5.	Total. 50.
F. Wake, Popanyinning	20	10	8	4	5	47
Cartwright, Bros., Wagerup	20	5	9	5	5	44
A. Mackay, Cookernup	20	10	10	3	...	43

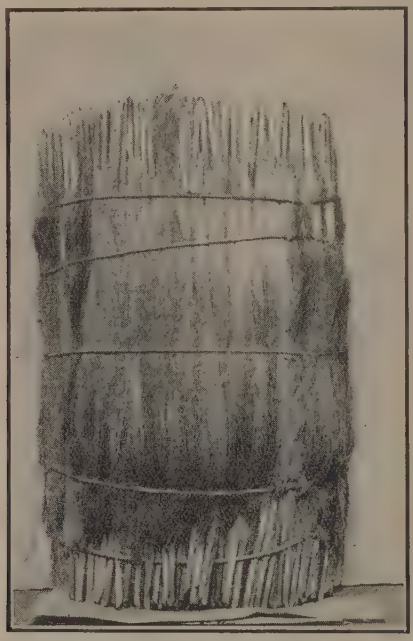
The following notes were made by the judges:—

F. Wake, Popanyinning.—The quality of the fibre was first class, being quite equal to the imported article. The colour of an even straw colour. The seeds had not been cleanly removed, but the fibre was quite clean enough for commercial purposes. The stalks on the short fibre had been cut too short. Fibre less than 15 inches should have been at least 6in. of stalk. The Italian method of packing had been used, as shown in Illustration II. This method does not exhibit the fibre to the best advantage, and is difficult to do without the proper machine.

II.—The winning bale, grown by Mr. F. Wake, Popanyinning.

Cartwright Bros., Wagerup.—Good long fibre, which had been rather spoilt in the drying. All the fibre for the last 6-8 inches was stained a reddish-brown colour, known in the trade as "red-topped," probably caused by packing before the portions bearing the seeds was properly dry. The length of stalks on the various qualities of fibre was good. Packing was excellent, as shown in Illustration III., this being the method usually practised in the Eastern States.

A. Mackay, Cookernup.—A fine self-working sample. A trifle short, but of excellent texture. Equal to anything imported from Italy or the Eastern States. Even light green colour. Was exceptionally well cleaned, there being not a seed on the whole consignment. The stalks on the short fibre, *i.e.*, insides and covers, had been cut much too short, as if each bundle had been cut with a guillotine. This package fell to pieces on the station, which cost the grower the prize, as the fibre was the best received at the factory.



III.—Bale grown by Cartwright Bros., Benger.

From the returns received from these and other growers, the following notes have been made, which will prove interesting to intending growers.

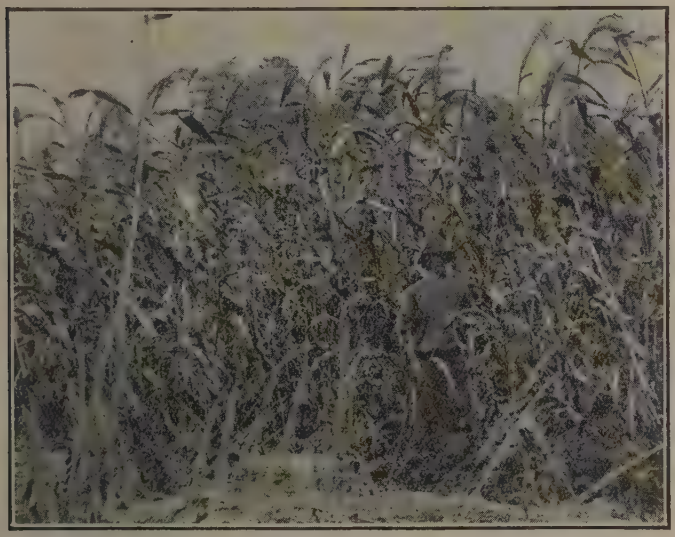
Preparation of Ground.—In only one or two instances was the ground fallowed early in the year in preparation for the crop, and this neglect undoubtedly reflected considerably on the yields and quality of fibre obtained In cases where proper cultivation had been carried out, yields ranged from six to 10 cwt. per acre.

Time to Plant.—Planting should be carried out as early as possible after danger from frosts is past. This will range from mid-September, around the latitude of Perth, to the end of November, in the wetter districts of the South-West. Where later plantings had been carried out, the rains commenced before harvesting could be completed, making drying a difficult operation.

Manure.—The crop responds well to farmyard manure, ploughed under at the time of fallowing. At the time of planting at least 2 cwt. of superphosphate should be applied. Where no farmyard manure is available, a dressing of ½ cwt. of sulphate of ammonia should be applied with the superphosphate.

Seed per Acre.—4lbs. per acre has proved sufficient.

Soil.—Broom millet grows best on well-drained semi-swamp loams, such as are found stretching from Serpentine to Brunswick, and throughout the South-West generally. An excellent crop, grown by Mr. A. Pianta, at Bullsbrook, on semi-swamp red gum and banksia light loam, has shown the suitability of this soil for the crop. See Illustration



IV.—Crop of Broom Millet on Mr. A. Pianta's Farm, Bullsbrook.

Wherever good maize crops can be grown broom millet will thrive.

These results are distinctly encouraging, and further point to the possibilities of this crop as a sideline for South-West farmers, especially those engaged in the dairy industry.

THE INTRODUCTION OF SUBTERRANEAN CLOVER INTO WESTERN AUSTRALIA.

GEO. L. SUTTON,
Director of Agriculture.

Subterranean Clover (*Trifolium subterraneum*) has proved so well adapted to the different soils in the wetter portion of the agricultural areas of this State that details regarding its introduction are of interest. It is also important to record them whilst those associated with the introduction are available to furnish the details.

The first recorded instance of subterranean clover seed being sown in this State is at Dyliabing, Katanning, by Mr. J. C. Warren. In the "Western Mail" of 29th March, 1923, Mr. Warren states: "In 1902 I brought back some seed of this clover from my old home at Mt. Crawford in South Australia, where my father had started it from seed which he got, I think,

The spot where Subterranean Clover was first planted at Mt. Barker in 1909.

from Mt. Barker in that State. It is a bit too dry about here for the clover, which has only taken hold in special places, but I distributed what seed I could spare, and I believe some of it was quite successful."

Apparently it did not spread to any extent from that centre, or at any rate not rapidly, for later two separate introductions were made into two different parts of the State, and about the same time. As recorded in the issue of the "Western Mail" already referred to, Mr. Berthoud, about 1907, obtained seed from Mt. Barker, South Australia, and planted it at Hamel in 1908, for in that year he supplied Mr. W. Catton Grasby with some rooted

plants of subterranean clover. These were planted by him in the agronomy plots at the Guildford Grammar School on 10th July, 1908. Mr. Grasby records that the plants grew and seeded remarkably well, and that enough seed was obtained to plant fairly large plots, which, in the following year, were sown at the Grammar School and also on Mr. Harper's "Purton" property across the river. Seed was also sent to "Ferndale," Balingup, and to Mr. Harper's property at Gingin. It is thus obvious that the introduction by Mr. Berthoud, through the agency of Mr. W. Catton Grasby, was responsible for the spread of this valuable fodder to several parts of the State, including portion of the South-West Dairy Belt.

Another independent introduction was that at Mt. Barker in this State, for in 1908 Mr. A. N. Martin, of Mt. Barker, W.A., who was on a visit to South Australia, was impressed by Mr. Fred Porter, who was interested in a property at Victor Harbour, with the great merits of subterranean clover then coming into prominence in South Australia, and had presented to him by that gentleman about 10 lbs. of seed. In the *Spring* of 1908 a small quantity was sown, but with unsatisfactory results. In the following *Autumn* of 1909 the balance of the seed was scattered in a corner of a paddock about a quarter of a mile in a north-easterly direction from the homestead on the Mt. Barker Estate. It was sown thinly with a crop, and attracted no particular notice in the following year. The succeeding year, however, attention was drawn to the patch on which the clover had been planted as the result of the partiality of the horses for grazing on it. On examination it was found that the plants had re-seeded themselves, for they were more numerous than in the previous year, but even then not as thick as at the present time. From the small area planted it spread throughout the whole of the paddock naturally and without any attention. This is believed to be the first seed introduced into the southern portion of the Western Australian Subterranean Clover Belt.

The illustration herewith shows the corner of the paddock on which the seed was sown by Mr. Martin in 1909 and from which it spread throughout the paddock and to other paddocks on the estate.

Consult nothing so much, upon every occasion, as safety. Now it is safer to be silent than to speak; and omit speaking whatever is not accompanied with sense and reason.

—*Epictetus.*

STINKWORT.

(*Inula graveolens*, Desf.)

W. M. CARNE, F.L.S., and C. A. GARDNER.

Stinkwort is one of our commonest and, in certain districts, one of the most troublesome weeds. It was formerly a proclaimed noxious weed. Now, however, it has become so gregareous in certain localities that any attempt to eradicate it must prove futile, unless conducted as an active campaign.

Inula is a Latin classical name for Elecampane (*I. Helenium*), a plant yielding an aromatic tonic, which was much used in earlier days; graveolens means strong- or offensive-smelling.

The plant would appear to have been first introduced into Australia in or about 1863 from Europe, and was recorded by Dr. Schomburgk in South Australia. At first regarded as a harmless weed of no consequence, it gradually spread until within a few years it had become quite a serious problem, and beyond control. We know nothing concerning the date of its introduction into Western Australia, but apparently it came from South Australia just as it spread into Victoria and New South Wales from that State. Stinkwort never appears to have been considered of any importance until it has obtained a hold over certain areas. The weed has been serious enough for many years in certain parts of the Great Southern districts, but as it has spread into the drier and more recently settled districts, its advent has even been welcomed as a new fodder plant apparently of little consequence as a weed, and providing early feed. This may be to some extent true. It is unlikely that it will ever become serious in the Eastern Wheat Belt, where the summer months are hot and dry, except on fallowed land where it may easily be controlled; but should summer rains be experienced the plant must become of consequence during such seasons. Stinkwort cannot be said to be of value as a fodder plant. Stock will eat it when young, provided that other feed is not plentiful, and that the land is well stocked. Stock will not attempt to eat older plants, beyond perhaps occasionally nibbling at them.

The best method of eradication where the weed is not plentiful is by pulling or hoeing out the plants when they are green. If allowed to stand until the flowers are forming it is quite possible that they will set seed even after pulling. Stinkwort belongs to the daisy family, each flower-head producing numerous seeds which are wind-distributed. Wherever Stinkwort first appears it is advisable to pull up all the plants seen. This may save much trouble later on.

DESCRIPTION OF PLANT.

An erect, usually symmetrical glandular-hairy, sticky, strong-smelling annual, 2-3 or even 4 feet high, with numerous sub-spreading branches subtended by oblong leaves. Leaves sessile (stalkless), concave, toothless, or rarely remotely and indistinctly toothed, the uppermost linear and entire. Flower heads terminal or axillary, narrow, with linear sticky bracts, the flowers yellow with rays exceeding the bracts. Achenes (seeds) almost cylindrical, downy, narrowed into a neck at the summit, the pappus bristles appearing simple to the naked eye.

Original home Mediterranean region, extending as far north as Paris, where it grows on stony and uncultivated ground.

EXPLANATION OF PLATE.

A, Plant; B, Stem leaf; C, Leaf from branchlet; D, Capitulum; E, Achene.

Stinkwort (*Inula graveolens*, Desf.).

PEAR SCAB (*Venturia pirina*).

A. FLINTOFF,
Orchard Inspector, Bridgetown District.

The question of effectively controlling the abovenamed disease has exercised the minds of pear-growers throughout Australia for a great many years, and a degree of success has followed the use of certain formulæ, but much has yet to be learned from a study of the factors as they relate to the geographical situation of the orchard, specific time of application of material for control, climatic conditions, etc. Proximity to the sea-coast has been found to be favourable to the development of Pear Scab, while in inland areas pear-trees are less subject to its attack. In the coastal areas of New South Wales the disease, uncontrolled, is responsible for a large percentage of unsaleable fruit, total loss being not uncommon; whereas in the higher inland orchards the damage is nothing like as severe, and almost complete control has followed the proper use of commercial Lime-Sulphur, this material having disappointing results nearer the seaboard. It appears obvious, therefore, that greater care must be exercised in low-lying coastal districts than in those favoured with a less humid atmosphere.

The time of application of remedies is a factor calling for serious consideration. No doubt climatic conditions control the specific time for applying remedies in the form of sprays.

With the fungoid disease under consideration the developmental stages are advanced or retarded by variations of weather conditions. Similarly, tree bud development may be early or late. Hence it is obvious that specific dates may not be a reliable guide to "Scab" control. The chief essential in this regard is to be satisfied as to the condition of leaf and blossom buds.

Districts having a low annual rainfall are not necessarily immune from "Scab" in the pear crop, although the theory has been advanced that where the rainfall averages around 26 inches the disease is not as pronounced as in the areas subject to a much heavier fall. This contention is somewhat substantiated where other conditions, such as freedom from night dews, obtain. Such conditions may be said to apply in Western Australia to localities as far inland as Dinninup on the Upper Blackwood; but in the Mount Barker area, with a similar rainfall, Pear Scab makes serious inroads on the crop. There, however, we have moist dewy evenings, and being nearer the coast, the district is favoured with a daily humidity more conducive to the development of fungoid pests. In Bridgetown, with a much heavier rainfall, pear-trees are not more susceptible to attack than in Mount Barker; therefore rainfall, without attendant advantages as instanced in the Dinninup area, seems to have little bearing on the subject.

With a view to test the efficacy for controlling Pear Scab of Commercial Bordeaux Mixture (Schloesing's) at varying strengths, and at different periods, an experiment was carried out at Bridgetown under the direction of Mr. Geo. W. Wickens, Superintendent of Horticulture, during the season 1926, and the results of one season's work are of interest to pear-growers.

A block of "Vicar" pear-trees was selected for treatment with Commercial Bordeaux (Schloesing's) Compound, the strength being varied to suit stages of bud development. Previous to 1926 these trees were known to become, each year, badly infected with Pear Scab.

1. Four trees were sprayed in autumn at a strength of 2 lbs. Bordeaux Mixture (Commercial) to 10 gallons of water. Time of application just as leaves began to fall.
2. Four trees were sprayed with Bordeaux (Commercial) once in autumn as for No. 1; again in spring as buds showed pink at a spray strength of 2 lbs. Bordeaux to 7 gallons of water.
3. Four trees were sprayed with Bordeaux (Commercial) as buds showed pink; strength of material 2 lbs. Bordeaux to 7 gallons of water.

One tree left untreated as a check.

The results obtained were:—

No. 1.—This treatment was found to be ineffective, fruit being badly spotted with "Scab."

No. 2.—The strength of Bordeaux (2 lbs. to 7 gallons of water) proved too severe when applied at pinking stage, as much of the tender growth was burned and blossoms destroyed, the effect being to russet the fruit permanently and show leaf damage throughout the season. Fruit practically free from "Scab."

No. 3.—Same result as with No. 2.

Check tree (unsprayed) showed 98 per cent. "spotted" fruit.

Conclusions:

Spraying with Bordeaux in autumn quite ineffective.

Spraying at pinking stage with Bordeaux at a strength of 2 lbs. to 7 gallons of water, while effective in controlling "Scab," is injurious to foliage and russets the fruit.

A further experiment was carried out to determine whether pear-trees could be safely treated with commercial lime-sulphur at a strength greater than that previously recommended at spur burst stage.

Three "Vicar" and three "Bartlett" pear-trees were sprayed with commercial lime-sulphur at a strength of one gallon lime-sulphur to 8 gallons of water—once when leaf and blossom buds commenced to swell, and again when *forward* blossom buds showed pink.

Results:

Treatment in this section proved satisfactory, russetting and "scab" being practically non-existent. Burning of the delicate first leaves was inevitable with lime-sulphur at the strength given, but this was slight and not in evidence later.

In view of the necessity for spraying with an insecticide in San José infected orchards, this experiment must be of great interest to those concerned, as the success of a dual purpose spray would obviate the use of two separate mixtures, namely, one for scale and the other scab control.

From the foregoing it will be seen that certain data has been recorded which, while being of value, may not be conclusive. Some growers have

contended from time to time that remedial measures have shown erratic results: some seasons certain treatment being successful, at other times the same material failing to give satisfactory control. Probably climatic variations have not been seriously considered in such instances. It is of the utmost importance that spraying shall be carried out according to bud development irrespective of any specific date. In this regard it may be of interest to quote from an authority writing in a bulletin of the Ohio Agricultural Experiment Station, 1926: "timeliness in application of sprays is probably the most important factor in disease control . . . if possible the programme should be adjusted according to resistance and susceptibility of varieties. . . . The practice of spraying here and there over a tree is almost certain to leave uncovered areas. In acreage operations it is best to spray with the wind and, when the wind changes to the opposite direction, to return and spray the other side of the trees. . . . One of the common mistakes, particularly in spraying large trees, is to spray the outer shell only and leave the inner branches practically untouched. . . . During summer operations, particularly if the sun is very bright, excessive burning may accompany temperatures above 80° or 85° (Ohio), especially if humidity is high. It is the practice in many commercial orchards to stop the sprayers when the thermometer reaches 85°. In some cases we have seen injury even in delayed dormant (first blossoms showing pink) spraying with lime-sulphur when the thermometer stood at 70° and the sun was bright."

The delayed dormant spray strength is given as 6¼ gallons lime-sulphur to 50 gallons of water, so that it will be seen that this strength, which is practically identical with that used in the experiment with lime-sulphur at Bridegtown, is considered safe only under favourable climatic conditions.

The writer in abovementioned bulletin also stresses the importance of studying the varieties of fruit treated, whether susceptible to disease or otherwise, also the necessity for completely covering every part of the tree with spray even if it necessitates several visits to the block under treatment.

The results of experiments outlined are not here given as being the last word in Pear Scab control and growers are advised to act cautiously regarding the use of materials at strengths which have not been thoroughly tried out. It is intended to carry out further tests during the coming season, the Bordeaux Compound to be applied at certain strengths to determine the proportion giving freedom from scab burning and russet. Lime-sulphur (commercial) will again be used as for last season.

Deliberate much before you say or do anything, for it will not be in your power to recall what has been said or done.

—*Epictetus*

EGG LAYING COMPETITION.

W. T. Richardson,
Poultry Adviser.

The first official Egg Laying Competition, conducted by Muresk Agricultural College, commenced on the 10th April, 1927, and will extend until the 31st March, 1928, both days inclusive.

This landmark in the progress of the poultry industry in Western Australia has been looked forward to by the poultry farmers with keen interest, which they have shown in a practical way by the number of the entries received.

Through unforeseen circumstances the number of pens it has been possible to erect has fallen short of the number it was originally intended to construct. Sooner than delay the inauguration of the first competition, possibly for another 12 months, it was decided to commence the tests this year with a reduced number of birds to one group; therefore, instead of six birds to one group or entry, each group consists of three birds, the desire of the College authorities being to see as great a number of poultry farmers as possible competing in this first test.

Fig. 1.—General view of Competition Pens.

All the work in connection with the construction and erection of the competition pens, including concrete floors, has been done by the College students, under the supervision of the Building Instructor (Mr. W. H. Harding), and great credit is due to them for the way in which this work has been done, especially when it is considered that the students had not received any previous tuition in constructional work. The completed pens are a thoroughly workmanlike job.

The Committee of Management consists of the Principal of the College (Mr. H. J. Hughes), the Poultry Adviser, Department of Agriculture (Mr. W. T. Richardson), and Mr. R. Aiken (Yaldarra Poultry Farm), the competitor elected by postal ballot.

The Directors of the *West Australian* Newspapers Ltd. have kindly donated the sum of £10 10s. for trophies in both sections of the competition.

It is the intention of the College authorities to ask the Hon. the Minister for Agriculture (Mr. M. F. Troy) to approve of the extension of the Egg Laying Competition pens so as to permit of the accommodation of groups of six birds in the 1928/29 Competition. This will bring the Competition into line with those held in the Eastern States.

It is hoped also that a feature of the 1928/29 Competition will be the institution of tests for ducks.

There are 90 pens to each row. The distance between the two rows of pens is 18 feet.

Muresk College is about 550 feet above sea level. The competition pens and poultry yards are on sandy loam, and on high ground, sloping to the East. The location is an ideal one for poultry.

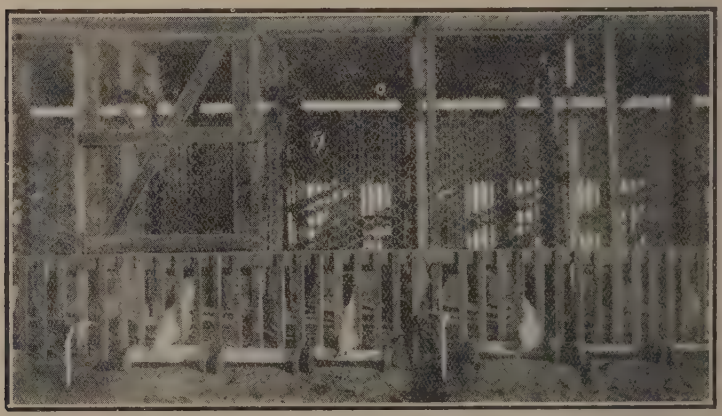


Fig. 2.—Front view of pens.

The houses, which are built on the continuous principle, are 5ft. high at the back and 6ft. high in front, with an 18in. eave, and each bird is singly and semi-intensively, housed, and has a floor space of 6ft. by 3ft., with a yard space of 6ft. by 3ft. The divisions in each pen are of netting, except every sixth pen, where the division is of galvanised iron. An opening 3in. wide along the top and whole length of the back wall has been provided for ventilation purposes. The perches are 3in. wide. 18in. high, and are movable, and each is provided with a droppings tin. The floor of the house is of concrete, raised 4in. above the ground level, and covered with litter, in which all the grain is fed. This provides exercise for the birds. The nest boxes are 12in. square, movable, made out of 6in. boards devoid of bottom, and are placed on top of the litter.

Feed tins, water vessels, and grit tins are placed outside the yards and are accessible to the birds through a slatted front with laths 2¼in. apart. The water is a gravity supply automatically controlled by ball cocks in concrete cisterns, placed at suitable distances consistent with the contour of the site.

Fig. 3.—View along one row of pens.

Gates have been placed at the division of every yard. The time and labour attached to evening feeding and gathering of eggs are consequently reduced to a minimum. Emergency gates are provided in front of and at every sixth pen. All pens are overhead netted.

Fig. 4.—Interior of one house.

It is intended to plant Cape Lilac (*Melia azedarach*) trees along the front of the pens for shade purposes. There being some doubts as to the

effects of its berries, toxic or otherwise, when consumed by poultry, a test has been carried out to determine that point, particulars of which appear elsewhere in this issue of the "Journal."

The following is a reprint of the Regulations and Conditions of entry governing the First Muresk College Egg Laying Competition:—

Muresk Agricultural College.

EGG LAYING COMPETITION.

Committee of Management.

The Committee of Management shall consist of the Principal of the College (Mr. H. J. Hughes), the Poultry Adviser, Department of Agriculture (Mr. W. T. Richardson), or officers acting in their stead, and one of the competitors to be elected by postal ballot by those to whom pens have been allotted.

Powers of Committee.

The Committee shall have absolute control of the Competitions conducted during its tenure of office.

It shall decide what tests are to be carried out during the ensuing year, and arrange the conditions and regulations governing same. It shall also receive applications and allot the pens for the next competition.

As soon as possible after the allotment of pens the election of a representative of the competitors for the following year's Committee shall be held.

The representative so elected shall take office on the 10th April succeeding the date of the election.

The Committee shall meet at least once in every three months on dates to be agreed upon or at such other times as the Committee may deem necessary.

Competition for 1927-28.

The first competition shall consist of two sections, in groups of three (3) birds:—

Section "A"—All Light Breeds.
Section "B"—All Heavy Breeds.

The competition shall extend from 10th April, 1927, until the 31st March, 1928, except that where a group or individual hen gives promise of making a record for the competition, they or she shall be allowed to remain at the College for the full period of twelve (12) months.

Each competitor shall be charged an entrance fee of 5s. per bird. This fee must be forwarded to the Secretary, Muresk Agricultural College, within fourteen (14) days after the allotment of pens, otherwise the pens may be allotted to another applicant.

For any of the above sections three (3) pure bred pullets must be supplied.

All eggs shall be the property of the Muresk Agricultural College.

Each of the pullets will be single tested, will be housed (semi-intensive), and the individual number and weight of eggs will be recorded.

Regulations.

1. In each section the competition will be decided by the highest number of units obtained by each group of hens and by each individual hen in their respective sections.

A first grade egg shall be rated as one unit, a second grade egg shall be rated as three-quarters of a unit.

2. During the first two months of the competition a first grade egg shall weigh not less than 1¾ ozs., thereafter during the remainder of the competition a first grade egg shall weigh not less than 2 ozs.

Second Grade.—The minimum weight of a second grade egg shall be 1½ ozs.

3. Eggs under 1½ ozs. in weight, or soft shelled, will not be counted.

4. The actual weight of each egg shall be recorded.

Note.—The certificate for the Winter test, 10th April to 9th July, 1927, shall be given subject to Rules 2, 3, and 4.

5. Any birds, the eggs from which do not attain an average of 24 ozs. to the dozen during the week ending 9th July, 1927, will be ineligible for individual prizes, excepting birds which have not laid within the prescribed weighing period shall be allowed until the week ending 6th August, 1927, to lay eggs of the average weight required. Any group of three birds the eggs from which do not attain an average of 24 ozs. during the week ending 9th July, 1927, shall be ineligible for group prizes.

6. Results will be published weekly as far as practicable and all prize money shall be paid as soon as possible after the termination of the competition.

7. No protest shall be considered unless received within 14 days from the termination of the competition.

8. Records shall be kept of the average cost per head of food consumed.

9. All pullets to be accepted must conform to the following conditions:—

(a) Shall have been bred by and be the property of the competitor, and the competitor must have owned the parent birds.

(b) Must be not less than six months, and not more than nine months of age on 10th April, 1927.

(c) Must be fair specimens of the breed.

(d) Must not weigh less than:—

Section "A"—Light Breeds: Leghorn, Ancona, Campine, 3½ lbs.; Minorca, 4 lbs.

Section "B"—Heavy Breeds: Orpington (any colour), Sussex, Langshan, Plymouth Rock, Rhode Island Red, 5 lbs.; Wyandotte, 4½ lbs.

10. All birds sent to the competition must conform to the weight prescribed in the preceding paragraph, otherwise the Committee shall cancel the allotment of pens in addition to which the entrance fee shall be forfeited.

11. Competing birds shall be treated for vermin and delivered at the Muresk Agricultural College, Muresk, between 6th April and 9th April, inclusive, in new coops or crates with the competitor's name and address clearly stencilled or painted thereon.

12. Freight to the College to be prepaid or delivery will not be accepted. Freight on rejected birds must be paid by the competitor.

13. All birds must be ringed with the numbered leg bands supplied and forwarded free to the competitor. These will correspond with the number of the pens allotted.

The pens having overhead netting it is unnecessary to cut any bird's wing feathers.

14. The Poultry Adviser shall have the power to reject any bird which in his opinion is not of the correct age, or which he considers does not conform in any way to Rule 9, and his decision shall be final.

15. At any time within seven days of the reception of the birds, any bird found to be suffering from an infectious or contagious disease, or with crooked breasts, or side sprigs in combs, or infested with stickfast flea when delivered at the College will be rejected and returned, and shall be replaced by a suitable one within seven days after the notification of same.

16. In the event of a bird during the course of the competition becoming diseased, incapacitated from laying, or developing vicious habits (such as egg-eating or feather-eating) it shall be returned, or on the written authority of the owner, destroyed.

Should this occur during the first three months of the competition, the competitor must replace it with another bird of the same age and breed. In the case of a bird dying, replacement may be allowed at any time. Any score standing to the credit of a bird which is replaced shall be struck out.

17. No competitor shall withdraw any bird until the termination of the competition, except as provided in Rule 16.

18. The Committee reserves to itself the right to inspect or to have inspected any applicant's stock with a view to determining whether the quality and character of the birds warrant the allotment of pens.

19. If, after pens have been allotted to any applicant, it is ascertained that incorrect information was furnished, the allotment will be cancelled and the birds returned, in addition to which the entrance fee shall be forfeited, and such person will be debarred from entry to any future competition.

20. Any competitor violating or failing to conform to these regulations shall be subject to such disqualification as the Committee may decide.

21. Where there is a tie for any place, the award shall be given to the competitor whose hen or group (as the case may be) lays the greater total weight of eggs.

22. The Committee's decision in all matters shall be final.

Prize List.

1. Group of Three Birds.—Sections "A" and "B."
   "The West Australian" trophies donated by Sir Alfred Langler: First prize £3 3s.; Second prize £2 2s. For the group pens obtaining the highest number of units during the term of the competition.
2. Champion Certificate.
   A Champion Certificate will be awarded to the group pen of three birds obtaining the best record in the competition.
3. Winter Test.—Sections "A" and "B."
   A prize of £1 1s. will be awarded to the group of three birds obtaining the highest total of units during the period 10th April, 1927, to 9th July, 1927, inclusive.
4. Individual Birds.—Sections "A" and "B."
   A prize of £1 1s. will be awarded to the individual hen obtaining the highest total of units during the term of the competition.
5. Government Standard Certificates.
   A Government Standard Certificate will be awarded to all birds laying not less than 200 eggs 2 ozs. or over during the term of the competition.

Muresk Agricultural College.
EGG LAYING COMPETITION.
1927-1928.

Application for Pens.

I hereby apply for a group of three pens in the Egg-Laying Competition at Muresk Agricultural College.

I declare the answers to the subjoined questions to be correct and undertake to abide by the rules and regulations hereto attached for the conduct of the competition.

Signature.....

Name under which entry is desired.....

Full Address.....

Nearest Railway Station.....

Date.....

Entrance Fee is 5s. per Bird.

The following particulars are required:—

1. What breed of fowls do you wish to enter.....
2. What strains are the foundation of your stock.....
3. How long have you been breeding the varieties mentioned.....
4. Have the pullets you wish to enter been bred from tested stock? If so, in which way have such stock been tested.....
5. How many birds of the same breed as those entered have you on hand.....
6. Any other breeds on hand.....
7. State the age on 10th April, 1927, of pullets you wish to enter.....

The entrance fee of 5s. per bird should not be forwarded by the applicant until he is advised that the pens have been allotted to him.

Applications should be addressed to—

The Principal,
Agricultural College,
Muresk.

IRRIGATION.

Part III.

A. R. C. Clifton,
Officer in Charge of Irrigation.

In the December issue of the *Journal* the preparation of the land, and construction of ditches, etc., was explained. It is now proposed to deal with the sources of water supply and some of the various means by which water is directed on to the land to be irrigated.

SOURCE OF SUPPLY.

The water may be obtained from underground by means of artesian bores and wells, or from surface supplies such as flowing streams and springs; and either scheme may be augmented by reservoirs and dams.

Artesian Water.—Satisfactory results can be obtained from many bores if the water is judiciously applied. Various qualities of artesian water are found, however, and whilst some can be used successfully for irrigation, others, being alkaline, are unsuitable, as they have an injurious effect on vegetation and soil. It is therefore most essential that the water be analysed before preparing for irrigation.

The bore should be put down on higher land than that to be irrigated, otherwise the water cannot be used to the best advantage without expensive fluming or power plant.

Irrigation has been practised with success for some years from bores near Perth, the Claremont Asylum farm being an excellent example of artesian irrigation.

Wells.—Before putting down a well it is advisable to sink a bore, not only to locate the supply, but to test the quality and quantity.

Hand-boring plants can be hired by settlers for this purpose from the Public Works Department. A deposit of £5 is required, the major portion of which is refunded when the plant is returned.

There is a large area underlaid with water-bearing strata of a sandy nature in Western Australia where water can be tapped at moderate depths. Under favourable conditions sufficient supplies have been obtained from a 4in. tube-well to warrant the erection of a windmill, but generally speaking it is necessary to sink a well. Where the water is located in less porous strata, a drive may be necessary to further enlarge the storage capacity and increase the supply by exposing a larger percolating area.

If the conditions are suitable for a tube-well, a perforated casing or strainer will be required to keep the sand out. There is an excellent strainer on the market known as Ashford's patent tube-well strainer, which consists of a framework upon which wedgelike-shaped wire is wound at high tension, so that when the strainer is in place the wire presents a flat surface to the surrounding water-bearing strata, with a slit between each strand of about 100th part of an inch. An important advantage of drawing on the underground supplies is that the water can be obtained handy to the land to be irrigated, and thus long channelling and the inevitable seepage losses are done away with. On the other hand, it is usually necessary to provide storage when the water is being obtained from wells.

Reservoirs and Dams.—The use of reservoirs and dams for storing water for irrigation purposes has so far received little attention in this State.

Reservoirs may be divided into two classes—natural and artificial.

Fig. 47.—Earth dam supplied by springs, Upper Swan.

In the first class are included reserviors where the greater part of the retaining banks are formed by nature, whilst on the other hand, artificial reservoirs are those of which practically all the banks are artificially constructed.

Fig. 48.—Sack dam and measuring weir on stream, W.A.

Natural reservoirs are used for the storage of river or rain water, not only for its various economic uses, but also, in some cases, to equalise the flow of rivers and minimise the danger of damage by floods.

Small artificial reservoirs serve the following purposes:—

1. They will permit a continuous 24-hour operation of pumping plants or flow from artesian wells without night irrigation, by storing the water at night for irrigating with during the day.
2. They allow the use of irrigation heads larger than the rate of the supply to the reservoir. The percentage of seepage and loss in the distributing ditches is therefore reduced.
3. The quantity of water which one man is capable of handling may be more easily supplied in this manner, thus reducing the cost of labour for irrigation.

Figure 47 shows an earth dam supplied by springs.

Where expense is a consideration, small sack dams can be used with advantage in many of our small streams and gullies during the summer months. (Figure 48.)

Fig. 49.—Concrete dam.

The source of water supply and quantity of water available, etc., will, of course, be carefully investigated before any actual work in connection with the irrigation scheme is commenced.

Having determined these factors, the next matter will be how to direct the water to the desired point in the distributing system from which it will be possible to irrigate all the land by gravity, unless the area is to be watered by sprinklers—in which case it will be under pressure and will be distributed by a system of piping. If the supply is higher than the land to be irrigated, pumping machinery will not be necessary.

The usual methods of gravitating water to the area to be irrigated are—

(a) open channelling;

(b) fluming;

(c) piping;

and all three may be used in connection with the one supply system, which generally follows the contour of the land.

The velocity of the water in a channel should not be fast enough to cause scour, and the supply ditch should be made large enough for the level of the water to be below the natural surface of the ground. However, if it is necessary to have the water level above the original ground surface, the channel site should have all vegetation removed and be plowed before commencing the artificial bank, to prevent any subsequent leakage.

Where serious seepage losses occur from the main ditch, owing to the porous nature of the soil, it is necessary to line the channel. The materials

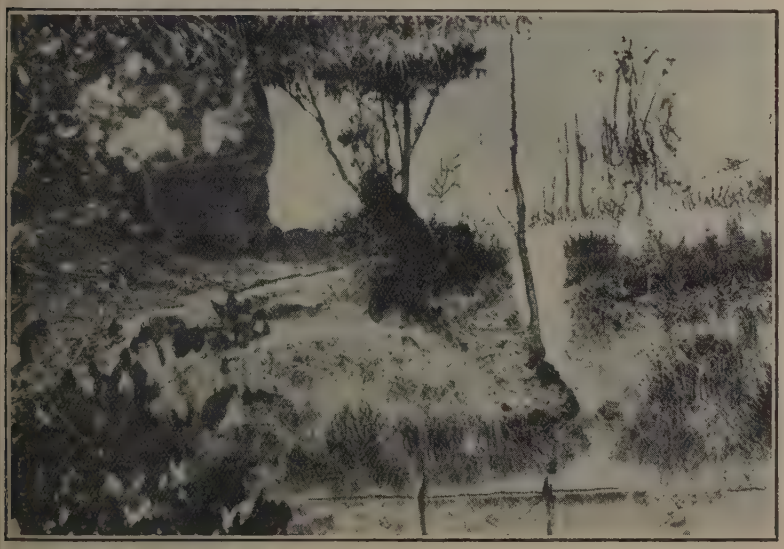


Fig. 50.—Sack dam and contour ditch.

used for this purpose are: cement, asphalt, clay, or puddle. Cement, however, has proved the most satisfactory, and will generally be found the cheapest in the long run.

In diverting the water from a running stream it will be necessary to head the water up by means of a dam or weir to enable the flow to be directed on to the land.

Figure 49 shows a cement structure for this purpose, provided with movable flash boards to enable the winter flow to pass down the stream, thus obviating floods. For permanent structures of this nature cement, where the conditions are suitable, is probably best, but timber or bags of sand, as previously mentioned, are satisfactory where it is not desired to go to the cost of cement.

Figure 50 shows the water being diverted from a small creek into a supply ditch by means of a sand-bag dam; whilst Figure 51 shows a sand-bag dam supplied with a spill-way enabling sufficient water to be obtained to operate a centrifugal pump.

To convey water across depressions, galvanised iron fluming is often used. Figures 52 and 53 show typical instances. Galvanised iron is also used for head ditches, small openings being provided at intervals for distributing water.

Wooden fluming has been used to a certain extent in Western Australia, but practice has demonstrated that our local timbers are not suited for this class of construction.

Fig. 51.—Sack dam and spillway.

Metal piping is sometimes necessary, but wood and also cement piping have proved satisfactory under suitable conditions.

If the water is to be conveyed by piping, it is important to know the fall and the distance, to enable the correct size of the pipe to be determined. The table (Figure 54), which gives the capacities of steel piping and is compiled by the manufacturers, will be useful in this connection. This is included by the kind permission of Messrs. Stewart & Lloyds (Australia), Ltd.

To illustrate the use of this table we will assume that 500 gallons per minute are required, and it is desired to determine what size pipe will be necessary to give this flow with a fall, say, of 50 feet through a distance of 500 feet. The grade, therefore, is 1 in 10. Reading across from figure 10 on the left-hand column of the table, 519.60 gallons per minute is found in the column headed by "5" (which will be the diameter, in inches, of the pipe required).

Fig. 52.—Galvanised iron fluming.

Fig. 53.—Galvanised iron fluming.

FIGURES GIVE DISCHARGE OF STEEL WATER MAINS IN IMPERIAL GALLONS PER MINUTE FOR GIVEN RATES OF FRICTION (1 FOOT HEAD IN ... FEET LENGTH OF MAIN); MEAN INCLINATION (1 FOOT FALL IN.....FEET LENGTH); VELOCITY (IN FEET PER SECOND OR MINUTE); AND DIAMETER (OF MAIN IN INCHES).

DIAMETER OF MAIN IN INCHES

	1	1¼	2	2½	3	4	5	6	7	
5	13·135	36·340	73·790	128·11	205·7	421·23	734·80	1149·3	1708·9	5
6	11·990	33·170	67·360	117·05	187·80	384·56	670·80	1062·7	1560·0	6
7	11·105	30·710	63·365	108·10	173·00	356·00	621·05	983·9	1444·3	7
8	10·386	28·725	58·355	101·35	162·65	333·00	580·90	963·71	1351·0	8
9	9·7917	27·06	55·000	97·12	153·40	313·95	547·70	867·20	1273·7	9
10	9·280	25 695	61 180	90·665	145·47	297·85	519·60	823·17	1208·4	10
15	7·600	20·980	42·650	74·025	118·80	243·30	424·30	672·12	986·63	15
20	6·570	18·170	36·900	64·110	102·85	210·60	367·40	582·07	854·45	20
25	5·900	16·250	33·000	57 340	99·000	188·40	328·60	520·62	764·22	25
30	5·350	14·833	30 130	52·345	88·980	171·95	300·00	475·26	697·64	30
35	4·950	13 735	27·890	48 470	77 755	159·20	277 74	440·80	645·90	35
40	4·650	12·895	26·695	45·335	72 730	148·95	259·80	411·59	604·11	40
45	4·370	12 115	24·595	42 740	68·575	140 40	245 00	388·05	569 63	45
50	4·150	11 490	23·330	40·550	65 055	133·20	232·35	368·13	540·40	50
60	3·809	10·490	21·305	37 010	59 385	121 60	212·10	336·06	493·32	60
70	3·550	9·710	19·720	34·270	54 980	112·57	196·40	311·13	456 72	70
80	3·270	9·084	18·450	32·055	51 430	105·30	183·70	291·04	427·22	80
90	3·094	8·565	17 390	30·225	48·490	99·280	173 20	274·39	402·79	90
100	2 940	8·125	16·500	28 630	46 000	94·137	164·31	260·31	382·12	100
110	2 800	7·747	15 730	27·240	43 860	89·804	156·68	248·20	364·34	110
120	2 681	7 417	15·062	26 172	41 992	85 981	150·00	237·63	348 82	120
130	2·575	7·126	14·471	25 146	40·345	82·608	144·11	228·31	335·14	130
140	2·483	6·867	13·945	24 231	38·877	79·603	138·87	220·00	322·95	140
150	2·398	6 634	13·472	23·409	37·559	76·903	134 16	212·54	312·00	150
160	2·323	6·423	13·044	22 666	36 366	74 462	129·90	205 80	302·00	160
170	2·253	6·232	12·950	21·989	35 280	72·238	126·03	199·65	293 07	170
180	2 190	6·056	12·298	21·370	34·286	70·203	122·47	194·02	284·82	180
190	2·130	5·894	11·970	20·800	33 372	68·330	119·20	188·85	277·22	190
200	2·077	5·745	11·667	20 273	32 153	66·600	116·18	184 07	270·20	200
250	1·838	5·139	10 937	18·135	29·096	59·576	103·93	164 65	241·76	250
300	1·696	4 691	9 5262	16 553	26 556	54·379	94 864	150·29	220·82	300
350	1·570	4·378	8·8196	15 325	24·588	50 345	87·828	139·14	204·25	350
400	1·469	4·062	8·2500	14 335	23·000	47 093	82·155	130·16	191·06	400
450	1·385	3·830	7 7782	13·515	21·685	44 400	77 456	122·61	180·13	450
500	1·314	3·634	7·3790	12 822	20·572	42 122	73 482	116·41	170·89	500
550	1·252	3·464	7·0356	12·225	19·165	40·163	70·062	111·00	162·94	550
600	1·200	3·317	6·7361	11 705	18 780	38·452	67 099	106·13	156·00	600
650	1·152	3·187	6·4718	11·246	18·043	36·943	64·448	102·11	149·88	650
700	1·115	3·071	6·2365	10·837	17·386	35·600	62·103	98·388	141·43	700
750	1·073	2·967	6·0259	10·469	16·797	34·392	59·998	95·052	139·53	750
800	1·039	2·873	5·8801	10·137	16·253	33·300	58·092	92·033	135·11	800

MEAN RATE OF INCLINATION 1 FOOT FALL IN ... FEET LENGTH OF MAIN

MEAN RATE OF FRICTION 1 FOOT HEAD OF WATER IN ... FEET LENGTH OF MAIN

1080 or 18 — 900 or 15 — 720 or 12 — 600 or 10 — 480 or 8 — 360 or 6 — 300 or 5 — 240 or 4 — 180 or 3 — 150 or 2·5 — 120 or 2 — 90 or 1·5

45 or ·75 — 60 or 1 — 75 or 1·25

VELOCITY IN FEET PER MINUTE OR SECOND.

VELOCITY IN FEET PER MINUTE OR SECOND

Fig. 54.—Friction Table.

FIGURES GIVE DISCHARGE OF STEEL WATER MAINS IN IMPERIAL GALLONS PER MINUTE FOR GIVEN RATES OF FRICTION (1 FOOT HEAD IN.....FEET LENGTH OF MAIN), MEAN INCLINATION (1 FOOT FALL IN.....FEET LENGTH); VELOCITY (IN FEET PER SECOND OR MINUTE); AND DIAMETER (OF MAIN IN INCHES)

DIAMETER OF MAIN IN INCHES.

FEET LENGTH OF MAIN.	8	9	10	11	12	13	14	15	16	FEET LENGTH OF MAIN.
5	2383·6	3207·9	4170·6	5288·3	6585·2	8035·5	9667·9	11501	13433	5
6	2176·0	2928·4	3807·2	4828·7	6011·5	7335·4	8825·5	10199	12263	6
7	2014·5	2711·2	3524·7	4469·4	5565·5	6791·3	8170·8	9720·5	11353	7
8	1884·4	2536·1	3297·1	4180·8	5206·1	6352·6	7643·1	9092·7	10620	8
9	1776·7	2391·0	3108·5	3941·7	4908·3	5989·3	7206·0	8572·7	10013	9
10	1685·3	2268·3	2949·0	3739·4	4656·4	5682·0	6836·2	8132·7	9498·7	10
15	1376·2	1852·1	2407·9	3053·2	3802·0	4639·3	5581·7	6640·4	7753·6	15
20	1191·8	1604·0	2085·3	2644·1	3292·8	4017·8	4833·9	5750·7	6716·6	20
25	1066·0	1434·6	1865·1	2365·0	2945·0	3593·6	4323·6	5143·6	6007·5	25
30	973·11	1309·6	1703·0	2158·9	2688·4	3280·5	3946·9	4696·4	5484·1	30
35	900·93	1212·5	1596·3	1998·8	2489·0	3037·2	3654·2	4347·2	5077·1	35
40	842·74	1134·2	1474·5	1869·7	2328·6	2841·0	3418·1	4066·3	4799·4	40
45	794·55	1069·0	1390·2	1762·8	2195·1	2678·5	3222·6	3833·8	4477·7	45
50	753·78	1014·4	1318·8	1672·3	2082·4	2541·0	3057·3	3637·4	4247·9	50
60	688·10	926·05	1203·9	1526·6	1901·0	2319·6	2790·8	3320·2	3877·8	60
70	637·46	857·35	1114·6	1413·4	1760·0	2147·6	2583·8	3073·9	3690·2	70
80	595·91	801·98	1042·6	1322·1	1646·3	2008·9	2417·0	2875·4	3358·3	80
90	561·83	756·11	983·00	1246·5	1552·1	1894·0	2278·8	2710·9	3166·2	90
100	533·00	717·30	932·56	1182·5	1472·5	1796·8	2161·8	2571·8	3003·7	100
110	508·20	683·93	889·16	1127·5	1403·9	1713·2	2061·2	2452·1	2863·9	110
120	486·56	654·81	851·31	1079·5	1344·2	1640·3	1973·1	2347·7	2742·0	120
130	467·47	629·12	817·91	1037·1	1291·5	1575·0	1896·3	2255·6	2634·5	130
140	450·47	606·24	788·16	999·40	1244·5	1518·6	1827·1	2173·6	2538·6	140
150	435·20	583·54	761·43	965·51	1202·3	1467·1	1748·9	2080·9	2452·6	150
160	421·37	567·08	737·25	934·85	1164·1	1420·5	1709·1	2033·2	2374·7	160
170	408·79	551·42	715·24	906·94	1129·2	1378·1	1658·0	1972·5	2308·8	170
180	397·28	534·65	695·11	881·38	1097·5	1339·3	1611·3	1916·9	2238·9	180
190	386·68	520·39	676·55	857·88	1068·3	1303·5	1568·7	1866·2	2179·2	190
200	376·89	507·22	659·42	836·15	1041·2	1270·5	1528·6	1818·5	2124·0	200
250	337·14	453·72	589·87	747·96	931·40	1136·5	1367·4	1626·7	1899·9	250
300	307·73	414·14	538·41	682·72	850·15	1037·4	1248·1	1484·8	1734·2	300
350	284·90	383·42	498·48	632·07	787·09	960·43	1155·5	1343·4	1605·6	350
400	266·50	358·66	466·28	591·25	736·25	898·40	1080·9	1285·9	1501·9	400
450	251·26	338·15	439·61	557·44	694·14	847·02	1019·1	1212·4	1416·0	450
500	238·36	320·79	417·06	528·83	658·52	803·51	966·79	1150·1	1343·3	500
550	226·81	305·86	397·65	504·22	627·88	766·16	921·80	1096·6	1280·8	550
600	217·60	292·84	380·72	482·75	601·15	733·54	882·55	1049·9	1226·3	600
650	209·06	281·42	365·78	463·82	577·56	704·76	847·93	1008·7	1178·2	650
700	201·45	271·12	352·47	446·94	556·58	679·13	817·08	972·05	1135·3	700
750	194·62	261·02	340·52	431·79	537·68	656·09	789·38	939·09	1096·8	750
800	188·44	253·61	329·71	418·08	520·61	633·26	764·49	909·27	1062·0	800

MEAN RATE OF INCLINATION 1 FOOT FALL IN = FEET LENGTH OF MAIN.

MEAN RATE OF FRICTION 1 FOOT HEAD OF WATER IN FEET LENGTH OF MAIN = VELOCITY IN FEET PER MINUTE OR SECOND

1400 or 24
1260 or 21
1080 or 18
900 or 15
720 or 12
600 or 10
480 or 8
360 or 6
300 or 5
240 or 4
180 or 3
150 or 2·5

90 or 1·5 — 120 or 2

VELOCITY IN FEET PER MINUTE OR SECOND.

Figure 55 is a gravitation scheme in the ranges, the source of supply being a spring with a flow of less than .5 cubic feet per second. This is a good illustration of what can be done with a small stream.

Centrifugal Pumps.—For situations where it is not possible to supply the ditch with water by means of gravitation it will be necessary to instal pumping machinery. The most suitable type of pump to use is, undoubtedly, the centrifugal, which surpasses all other forms for lifting large quantities of water to moderate heights, and combines strength and simplicity of construction with moderate first cost.

This pump requires little foundation (Figure 56), and the erection, which is simple, can readily be carried out in awkward positions. Where applicable, the centrifugal is by far the best type for irrigation and drainage purposes, and, having no valves, is especially adapted for raising water containing foreign matter, such as grit, leaves, etc., which would soon choke an ordinary pump.

Fig. 55.—Panorama of small gravitation scheme.

Figure 57 shows the various parts of a centrifugal pump.

The impeller, which is fitted with a series of curved blades, is keyed on to the shaft and revolves in the outer shell or bowl—on a somewhat similar principle to that of a fan blower.

The water is drawn in at the centre and forced out through the vanes of the impeller into the discharge. The necessary pressure is imparted by the centrifugal motion.

Good results are obtained by the proper use of these pumps, of which there are different designs for "low" and "high" duty purposes. It is therefore necessary to instal the right type of pump for the work to be performed, and the satisfactory working of same will depend on the running of the pump at the proper speed, which varies according to the head.

The efficient capacity of a centrifugal pump is not constant, but varies directly with the head.

The pump should be placed as near the water as possible, and before starting up must be "primed," through a plug provided for the purpose in the bowl of the pump, and to enable this to be done a foot valve is necessary on the suction end of the pipe.

Every care should be taken to ensure that all joints on the suction side of the pump are absolutely air-tight.

Pipes.—All pipes must have a clear waterway at least equal in area to the section and discharge branches of the pump. Pipes of larger diameter are always to be recommended, and more especially where a considerable length of piping is required. Great care must be taken to prevent the packing between pipe flanges projecting into the pipes and to guard against air traps being formed in the pipes or pump, as such defects may prevent the pump from discharging any water.

Fig. 56.—Centrifugal Pump, showing simplicity of installation.

Use as few "bends" as possible, and never use short right-angled bends; wherever necessary, the "long bends" or "springs" should be employed.

To prevent washing of soil at the point where the pump discharges into the channel it is always necessary to form a sump or basin. This can be constructed of either brick, stone, cement, or in some cases an iron tank can be utilised.

Figure 58 shows a discharge basin formed with bricks laid without mortar or cement.

The use of light flanged galvanised piping will be found very economical in many cases. For 8 or 10 inch pipes 16 gauge should be used, but for 5 or 6 inch pipes 18 gauge will be found sufficiently strong.

IRRIGATION POWER PLANTS.

Where power has to be used for raising the water the question of cost is of vital importance—not so much the initial cost as the running expenses.

Where electric power is not available the oil engine has been found very satisfactory, more so than the steam engine, as the latter requires the constant attention of a certificated driver, whereas the oil engine can be left for several hours at a stretch, thus enabling the small irrigator to attend to the work himself.

The crude oil engine is invaluable, especially where there is a large scheme, and though the first cost is more than that for the kerosene engine, the running expenses are considerably less.

To estimate the power required to drive a pump, its capacity and efficiency, together with the total head against which it has to operate, must be known.

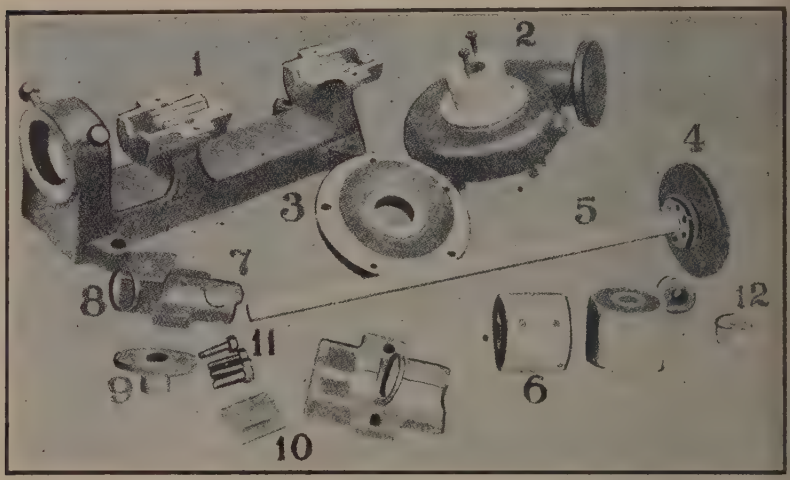


Fig. 57.—The different parts of a Centrifugal Pump:

1. Bedplate.	4. Impeller.	7. Bearing Cap.	10. Cap of Oil Box.
2. Bowl.	5. Spindle.	8. Oil Ring.	11. Studs.
3. Faceplate.	6. Pulley.	9. Gland.	12. Thrust Collars.

"Total Head."—This term denotes the "lift" plus the "friction head."

"Lift."—There is often some misunderstanding regarding the term "lift," which refers to the vertical distance from the water level to the point of discharge and includes "suction lift" and "pressure lift" exclusive of "friction head." When it is wished to indicate the height the pump is placed above the level of the water supply, the term "suction lift" is used.

"Friction Head."—In forcing the water through piping, bends, etc., a certain amount of resistance, or friction, is set up, which is equivalent to lifting the water so many more feet. This pipe friction is termed the "friction head," and extra power must be provided to overcome it, and also to allow for the pump efficiency.

Fig. 58.—Receiving basin and sump with bulkhead in distance.

"Pump Efficiency."—This will vary according to type, size, and condition of operation; 50 per cent. is usually a safe margin to figure on.

The table (Figure 54) will enable the "friction head" to be determined.

For instance, suppose it is desired to instal a 5in. pump with a capacity of 550 gallons per minute and deliver water through 200 feet of piping, what would be the "friction head"?

Under column 5 (diameter of pipe in inches) the figure 547.70 will be found (approximately 550 gallons per minute), and in line with the same on the right-hand side of the table is shown the figure 9. Therefore, the mean rate of friction will be one foot head in every nine feet of pipe, and the velocity will be approximately 11 feet per second (as indicated by the graph line across the table).

550 gallons per minute through a 6in. main would have a mean rate of friction of one foot head in every 23 feet of pipe, and a velocity of 8 feet per second.

550 gallons per minute through a 7in. main would have a mean rate of friction of approximately one foot head in every 50 feet, with a velocity of 5.5 feet per second.

Horse-power.—One horse-power will lift 3,300 gallons one foot per minute, but if the efficiency of the pump is 50 per cent., only 1,650 gallons would be lifted; therefore, by multiplying the flow in gallons per minute by the "total head" in feet and dividing by 1,650, the h.p. necessary to drive the pump is determined.

To continue the foregoing illustrations, suppose the lift is 30 feet and the pump efficiency 50 per cent., then the horse-power necessary if a 5in. main is used will be—

$$\frac{\text{Gallons per minute.}}{3{,}300} \times \frac{\text{Total Head. Lift. (30} + \text{Friction Head. 23)}}{} \times \frac{\text{Pump Efficiency. 100}}{50} =$$

$$\frac{550 \times 53}{1{,}650} = 17{\cdot}6 \text{ H.P.}$$

With a 6in. main—

$$\frac{550 \times 39}{1{,}650} = 13 \text{ H.P.}$$

With a 7in. main—

$$\frac{550 \times 34}{1{,}650} = 11{\cdot}3 \text{ H.P.}$$

The best results in this instance will be obtained by using a 7in. main.

Even if pumping operations are intermittent the extra cost of the 7in. over the 6in. main will probably be justified (depending on the type of engine installed), for the saving effected by using the smaller sized pipe may easily be counteracted by increased running expenses and the extra cost of the larger engine.

The 5in. piping is, of course, not feasible, and clearly indicates the necessity of fitting centrifugal pumps with mains of ample diameter.

Figure 59 shows a typical small irrigation plant in the South-West.

Windmills.—The use of windmills for pumping water is to be recommended wherever a small supply exists.

For practical irrigation purposes, however, the lift must be low, as the limited power of the ordinary windmill is not sufficient to pump the large volume of water needed more than, say, 50ft. or 60ft., although for stock and domestic supplies more than double this head is quite feasible.

Their usefulness is limited by the wind, and it is always necessary to provide large tanks or storage reservoirs for irrigation requirements.

Fig. 59.—Typical irrigation plant in the South-West.

The coastal areas of this State are specially favoured with strong, steady, reliable winds during the summer months, creating most suitable conditions for the use of windmills. It has been demonstrated that the 12ft. mill will lift to a height of 50 feet enough water to irrigate three acres to a depth of 4 inches every month during the summer. With a 25ft. lift, double that quantity of water could be pumped.

We have many examples in this State of small areas being watered by windmill power; but as a rule the mills are too small to perform efficient work.

Hydraulic Rams.—These will often prove extremely useful and economical for raising water where a sufficient fall is available. The principle on which they work is that a larger volume of water, having a certain fall, will force, under certain conditions, a smaller volume of water to a higher point than itself. In estimating the amount of water that can be raised and discharged, a general rule is to caluclate that about one-seventh of the water used can be raised and discharged at a height four times as high as the fall, or one-fourteenth to eight times the height of the fall, etc.

The drive or supply pipe should be placed at an angle of not more than 30 degrees in order to give the best results, and the length should not be less than three-fourths of the height to which the water is to be raised. In both supply and discharge pipes all acute angles should be avoided.

Hydraulic rams will work without interruption day and night, and require practically no attention.

POTATO CHIPS.

G. N. Lowe,
Senior Potato Inspector.

A REMARKABLE YIELD.

Particulars of a very heavy yield from a few large potatoes are recently to hand, and would again tend to explode the theory held by some growers that very large tubers are not desirable as seed. Why such an idea can be entertained, provided the said large potatoes are normal and otherwise healthy, is hard to understand.

It will be remembered by most *Journal* readers, that in the last June issue, mention was made of portion of a crop grown by Mr. A. E. Martin, of Young's Siding, which produced at the rate of 20 tons per acre.

Arrangements were made with Mr. Martin to send along, for exhibition at the Royal Show, in the section attaching to the Potato Branch, one bag of the largest shapely tubers from his heaviest yielding plot. It was found on arrival that 89 potatoes filled the bag, and that the average weight of each was well over 2lbs., so that some idea may be gained of their size.

In order that the tubers should be in good condition for the Show, the bag was kept in cool store from March to October, this treatment, of course, from a seed standpoint, not being desirable. The potatoes were subsequently exhibited and aroused much comment at the Show. They were afterwards placed on a rack at this Office.

In November, a kerosene box, containing 34 tubers, was sent to Mr. J. Jeweller, of Hamel, who had expressed his willingness to plant them with the idea of retaining whatever the yield might be for further trial.

Owing to over-wetness across the centre of the plot planted, about 25 per cent. of the 350 sets cut failed to germinate, but despite all the foregoing disabilities, 6½ bags of excellent potatoes were dug. This means that 8cwt. of potatoes were returned from 260 plants, or a computed yield of 18 tons per acre.

THE HANDLING OF SPROUTED SEED.

Frequently sufficient attention is not paid to the very important question of retaining the original sprouts of seed potatoes at planting time, and through rough handling, or lack of care, these are lost.

It is quite easily understood that successive breakings off of the shoots must have a weakening effect on the seed, and these should certainly be conserved, if possible, from the first.

Cutting sprouted seed into bags to be carted into the paddock, and again filling the "koota" or planting bag from them, accounts for practically every bud being lost, and this can quite easily be avoided by a simple method largely in vogue in the Albany district, where only sprouted seed is planted.

Petrol or kerosene tins are used, which have one side removed and a hole punched in each end, into which is fitted a movable handle made of stout wire. The seed is cut straight into the tins, proper care being exercised in this operation to preserve the buds. The tins are then taken to the pad-

dock, and disposed along the "land," as required for planting, and the handle transferred as each tin is emptied. The tins are slid along the edge of the furrow, as the planter proceeds, the actual planting being accomplished with the free hand. Care should again be taken to avoid sprout injury, and at the most, three "sets" only taken at once in the hand.

Another type of handle in use is made of a piece of round wood, rather shorter than the inside measurement of the tin, and into each end of which is driven a stout nail, only sufficiently long to allow of the handle slipping out when needed.

The above method of handling seed is, of course, rather slower than planting from the "koota," but will well repay the time and trouble expended.

"WET BAG" TREATMENT OF SEED FOR SUMMER PLANTING.

Amongst other growers induced to treat cut seed in wet bags to insure a proper germination this summer, was Mr. Ray Clarke, of Roelands, who is now delighted with the results obtained. The season was, however, more favourable than usual for cutting seed and planting at once, owing to

Illustration No. 1.
Showing germination of "round" seed in Mr. Ray Clarke's crop when five weeks above ground.

cool conditions. Mr. Clarke, at one period during planting, was delayed for four days, and, as his treated seed for the trial was waiting for that time, he was so dubious about the prolonged bagging that he decided there was very little chance of its coming to anything worth while, and planted it in an out of the way spot together with a bag or two of whole small tubers, graded out from the same line of seed.

Illustration No. 1, shows the germination of the whole seed when five weeks above ground, and Illustration No. 2, the large cut seed treated in the

wet bags, planted the same day alongside and otherwise under identical conditions. An outstanding feature of these photos (of course taken at the same time), is the difference in the stages of maturity, the cut treated seed being quite three weeks in growth ahead of the small whole seed, and out in flower as the picture shows.

Illustration No. 2.

Showing the even germination and vigour of large seed cut and treated by the "wet bag" method. Compare with Illustration No. 1 planted the same day under exactly similar conditions.

Even more impressive is the yield from each class of seed. Illustration No. 3 depicts the return of five tons per acre, as against eight tons in Illustration No. 4 of large cut treated seed from the same crop. The difference in favour of the latter can be ascribed to two reasons—first, that the germination was almost perfect, and, again, that the reproductive strain of the large tubers would reasonably be greater.

THE DIPPING OF SEED.

This operation, for the control of Scab and Rosette (*Rhizoctonia*), is not so generally followed by potato growers as is warranted. The object of it is, of course, to keep down the diseases mentioned in the immediate crop, and also to prevent the land becoming infected by unclean seed and so transferring the trouble to later cropping.

Dipping can only be effective against skin troubles, and is not, as sometimes supposed by growers, of use in controlling internal disease, such as Wet Rot, Brown Ring, etc.

Scab and Rosette are very generally distributed, and of the two, Rosette causes the greater loss, owing to the limitation of the yield. Probably Rosette is not nearly so well known as Scab, but may be most readily recog-

nised by the small aerial tubers up the stem as one phase on the growing plant, and in the resting stage by small, hard black patches on the skin of the tuber.

These patches are so common, that they are invariably regarded as small particles of soil adhering to the skin, and are accordingly considered as of no account, but actually, the disease gives rise to and causes much loss, and systematic dipping is the greatest safeguard.

Either of two chemicals can be successfully employed, Corrosive Sublimate (Mercuric Chloride) or Formalin, though the former is more effective, but must be handled with great care, as it is a deadly poison. The proportions are—

Corrosive Sublimate	4 ozs.
Water	30 gallons.

This gives a strength of 1 : 1,200, and in this mixture *dormant uncut* seed should be immersed for 1½ to 2 hours, and then spread out to dry. Very

Illustration No. 3.
Five tons per acre from small whole seed.

soon after the seed has been dug, 2ozs. to 500 gallons may be safely used, but not at a later stage. To keep the mixture up to strength, add three-eights of an ounce of the chemical after treating every second bag, and add water to bring up to the original 30 gallons.

The crystals are far more quickly dissolved in a small quantity of boiling water in the first place, and this procedure considerably lessens the time taken in the dipping operations.

Wooden or cement containers should be procured, as Corrosive Sublimate eats holes in metal, although galvanised tanks may be used if first

protected with asphaltum paint, which may be purchased ready mixed from paint suppliers. Bags are quite satisfactory for holding the seed whilst in the tank.

Corrosive Sublimate, it has been established, is more effective by 10 to 1 than Formalin, but because of its extremely poisonous properties, proper care must be taken to keep it out of the reach of children and farm stock. The solution is colorless, tasteless and odorless and likely to be mistaken for water if left exposed. *Treated potatoes must not be used for food or fed to stock.*

Formalin should be used at the rate of 1lb. to 30 gallons of water, and, as in the case of Corrosive Sublimate, immerse *unsprouted uncut* seed for the same period. With this solution, it is not necessary to make any addition to keep it up to strength. A second dipping a fortnight later, provided the seed is not too forward, is recommended with the formalin mixture.

Illustration No. 4.
Eight tons per acre from large cut seed treated in wet bags prior to planting.

THE VALUE OF PROPER DRAINAGE.

An excellent example of the value of proper and systematic drainage of potato land is afforded in the following illustrations, which depict the conditions on well drained land on the farm of Mr. J. Brighton, Elleker, and those on exactly similar land, undrained just over the fence, planted at the same time with similar seed and manure.

In its original state this soil, which is of a stiff, marly nature, does not suggest itself as desirable for potato production, but with the necessary drainage and intelligent working, gives splendid returns.

Mr. Brighton is fully alive to the necessity of getting the water off his land at the first possible moment after the winter accumulation, and has his

whole swamp area divided into three acre plots by means of well made. open drains, and intends putting in another in each through the centre.

Illustration No. 5 shows a crop of "Factor" planted on 14th December, 1926, which has since yielded from 10 to 11 tons per acre; No. 6 illustrates

Illustration No. 5.

Crop of "Factor" grown by Mr. J. Brighton, Elleker, on well drained swamp, which yielded 10 to 11 tons per acre, despite 6 inches of rain in two days at one period of their growth.

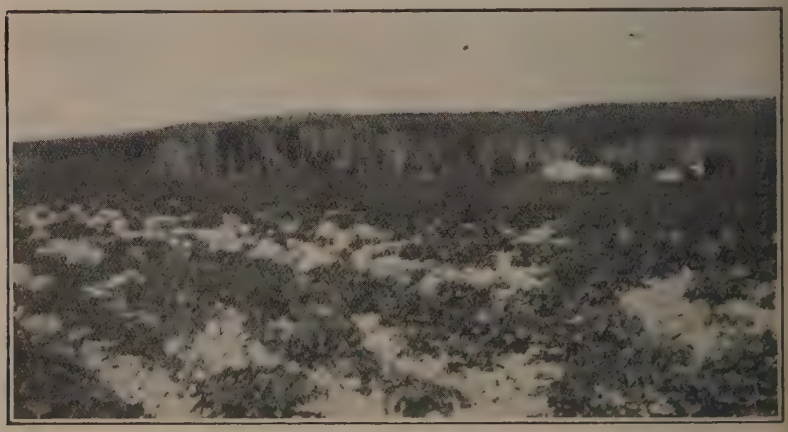


Illustration No. 6.

Crop of "Factor" grown on undrained swamp at Elleker, which returned only 2 tons per acre.

a crop of "Factor" planted alongside, under Mr. Brighton's supervision on 15th December, 1926. This crop returned only two tons per acre, and the only difference was the lack of drainage.

Mr. Brighton is also a great believer in very thorough working of his soil, and states that last year from the initial plowing to the final cultivation of his crop, he worked his 36 acres with some implement 20 times. Plowing to the maximum depth of the implement is given early in the season, the actual planting depth, however, being 4 to 5 inches.

THE QUESTION OF SEED.

Mr. Brighton has latterly grown "Factor" almost solely because of the difficulty in procuring really reliable "Delaware." This season he decided to again give "Delaware" another try, and obtained some good seed from along the Denmark line, and of the same strain as the Certified Seed, which did so well in the South-West last winter planting. Another line of seed he obtained from a large swamp area in another district, from which much seed used to be drawn for the Great Southern plantings.

Illustration No. 7.

"Delaware" grown by Mr. J. Brighton, Elleker, which produced 11 tons per acre, from Denmark Line seed of similar strain to that certified to by the Potato Branch.

Illustration No. 7 shows the crop from the Denmark line seed, which produced 11 tons per acre, and No. 8 the other purchase, which returned only two tons. Very noticeable in this picture is the variety known as "Yellow-tails" in the South-West. These are called "Stars" in the Albany district, possibly because any grower getting them will "see stars" when he inspects his crop.

WHEN CUTTING SEED.

Due to the ever present risk of carrying infection from diseased tubers when cutting up seed and so transmitting the trouble to numerous others by means of the infected knife, it is a wise and simple precaution to provide a small tin of 5 per cent. formalin and water solution into which the knife may be dipped and so disinfected.

Illustration No. 8.

Crop of "Delaware" and "Stars" (which stand out prominently), which yielded only 2 tons per acre, from seed better turned into pork.

Wet Rot had been rather prevalent this summer, and enough spores of this can be conveyed on a knife blade to eventually infect a whole paddock.

At certain stages such diseases are only detected when a tuber is cut, and each showing any internal blemish, should be rigidly discarded. It is quite a serious mistake to delegate the cutting of seed to inexperienced persons, whether old or young.

A ship ought not to be fixed by one anchor, nor life on a single hope.

—*Epicletus.*

FRUIT EXPORT.

GEO. W. WICKENS,
Superintendent of Horticulture.

Apple growers in Western Australia this year have been "favoured of the Gods." A record crop, record export, high quality fruit, strong demand, and good prices make a pleasant summing up of this season's experience. Even shipping difficulties were absent, for with the light crop in the Eastern States, more refrigerated space was offering on the boats than was required, and, finally, shipping freight was lower than it has been for many years past.

Full details of quantities shipped from 1st January to 5th May, and destinations, are shown hereunder, and it will be noted with interest that a considerable portion of this season's fruit found a market on the Continent of Europe.

As stated above, the number of cases exported constitute a record, the previous one being established in the season of 1922-23, when for the whole year ending 30th June, 1923, 407,085 cases were sent overseas. In the corresponding period of 1926-27 over 550,000 cases will be exported.

EXPORT OF FRESH FRUIT FROM WESTERN AUSTRALIA FROM 1ST JANUARY TO 5TH MAY, 1927.

Vessel.	Date of Departure.	Destination.	Apples.	Grapes.	Pears.	Peaches.	Quinces.	Passion Fruit.	Oranges.	Plums.	Nectarines.	Lemons.
	1927.											
"Centaur" ...	Jan. 14	Batavia ...	...	20	...	...	...	...	50	20	...	...
		Sourabaya	...	...	...	...	...	...	...	15	...	...
		Singapore	10	117	...	...	...	...	19	108	7	...
"Kangaroo" ...	Jan. 14	Singapore	...	74	18½	...	...	...	...	20	...	...
"City of Palermo"	Jan. 18	Batavia ...	...	...	...	...	...	...	...	...	...	...
		Sourabaya	255	...	...	...	...	...	...	...	...	...
"Gascoyne" ...	Jan. 30	Batavia ...	50	80	12½	...	...	...	...	25	...	...
		Sourabaya	522	90	12½	...	...	...	...	10	...	...
		Singapore	428	363	12½	...	...	...	...	40	...	...
"Ormuz" ...	Jan. 31	Colombo	442	65	...	...	...	...	...	...	...	...
"Jervis Bay"...	Feb. 3	Colombo	268	300	...	...	...	...	...	...	...	...
		Port Said	80	...	...	...	...	...	...	...	...	...
		London	...	16	175	...	...	...	...	57	...	...
"Moldavia" ...	Feb. 7	London	...	101	705	...	...	...	...	...	...	...
		Colombo	...	790	...	...	...	...	...	...	...	...
"Minderoo" ...	Feb. 13	Batavia ...	...	66	20	...	...	...	...	15	...	...
		Sourabaya	...	162	20	...	...	...	...	16	...	...
		Singapore	1,001	642	44	4	...	...	...	25	...	...
"Orsova" ...	Feb. 15	Colombo	739	536	...	...	...	...	...	...	...	...
"Naldera" ...	Feb. 21	London	...	1 149	479	...	...	...	...	...	...	...
"City of Sparta"	Feb 22	Batavia ...	598	241	4½	...	...	...	...	3	...	...
		Singapore	1,678	1,162	34	...	...	...	...	...	...	...
		Sourabaya	1,868	667	61	...	...	...	...	...	...	...
"Gorgon" ...	Feb. 26	Singapore	399	...	...	...	...	...	...	...	...	...
"Kangaroo" ...	Mar. 1	Batavia ...	195	219	48	20	...	...	1	11	...	...
		Sourabaya	155	825	100	34	...	...	...	30	...	...
		Singapore	2,177	3,354	...	80	50	...	...	7	...	...
"Ballarat" ...	Mar. 3	London ...	29,349	841	2,009	...	25	...	...	...	...	...
"Ferndale" ...	Mar. 4	London ...	20,840	3,315	417½	...	...	9	...	...	...	...
		Port Said	367	...	...	...	...	...	...	...	...	...
		Hull ...	6,300	...	...	...	...	...	...	...	...	...
"Chitral" ...	Mar. 7	London ...	...	792	117	...	...	...	...	...	...	...
"Medic" ...	Mar. 9	London	11,053	...	2,014½	...	...	...	...	...	...	...
		Liverpool	121	...	...	...	...	...	...	...	...	...
"Woodarra" (Albany)	Mar. 12	Hamburg	12,799	...	1,340½	...	...	...	...	...	...	...
"Centaur" ...	Mar. 11	Singapore	928	884	...	6	...	...	...	...	...	...
		Batavia ...	92	80	...	...	...	...	...	...	...	...
		Sourabaya	180	175	...	...	...	...	...	...	...	...
"Otranto" ...	Mar. 14	Colombo	717	1,215	...	...	...	...	...	...	...	...
		London ...	2,494	2,377	230½	...	...	...	...	...	...	...
"Port Brisbane" (Albany)	Mar. 19	Hamburg	13,933	...	244	...	...	...	...	...	...	...
		Stockholm	10,383	...	...	...	...	...	...	...	...	...

EXPORT OF FRESH FRUIT FROM WESTERN AUSTRALIA FROM 1ST JANUARY TO 5TH MAY, 1927—*continued.*

Vessel.	Date of Departure.	Destination.	Apples.	Grapes.	Pears.	Peaches.	Quinces.	Passion Fruit.	Oranges.	Plums.	Nectarines.	Lemons.
	1927.											
"Woodarra" ...	Mar. 17	Gottenburg	750	...	...	...	...	...	...	...	...	...
		Stockholm	2,900	...	...	...	...	...	...	...	...	...
		Hamburg	18,856	...	64	...	...	...	...	...	...	...
		Copenhagen	891	...	...	...	...	...	...	...	...	...
		Port Said	100	...	...	...	...	...	...	...	...	...
"Balranald" ...	Mar. 23	London ...	13,823	...	3,944⅔	...	...	...	...	...	...	...
"Narkunda" ...	Mar. 21	London ...	2,942	...	...	...	...	...	...	...	...	...
"City of Palermo"	Mar. 23	Singapore	1,780	523	15	...	4	...	...	...	...	...
		Batavia ...	738	254	63½	...	...	...	...	...	...	...
		Sourabaya	1,109	248	60	...	...	...	...	...	...	...
"Berwickshire"	Mar. 25	London	9,903	482	674	...	3	...	...	...	...	...
		Manchester	1,090	291	...	...	...	...	...	...	...	...
"Kent" (Albany)	Mar. 28	Hamburg	18,975	...	185⅔	...	...	...	...	...	...	...
"Euripides" ...	Mar. 30	London ...	14,041	...	2,772½	...	...	...	...	...	...	...
		Liverpool	60	...	...	...	...	...	...	...	...	...
"Ormonde" ...	Mar. 28	Colombo	625	955	...	...	...	...	...	...	...	...
"Port Brisbane"	Mar. 24	Stockholm	14,813	...	...	...	...	...	...	...	...	...
		Antwerp ...	80	...	...	...	...	...	...	...	...	...
		Hamburg	15,455	...	86	...	...	...	...	...	...	...
		London	12	...	...	...	...	...	...	...	...	...
"Largs Bay"	Mar. 25	Colombo	659	772	...	...	...	...	...	...	...	...
		Hull ...	8,542	...	...	...	...	...	...	...	...	...
		London	15,324	2,371	2,193½	...	...	...	...	...	...	...
		Port Said	750	...	...	...	...	...	...	...	...	...
"Kent" ...	April 2	Gottenburg	700	...	...	...	...	...	...	...	...	...
		Stockholm	1,374	...	...	...	...	...	...	...	...	...
		Copenhagen	1,000	...	...	...	...	...	...	...	...	...
		Hamburg	24,163	...	23	...	...	...	...	...	...	...
		Bremen	250	...	...	...	...	...	...	...	...	...
		Malino ..	150	...	...	...	...	...	...	...	...	...
		Kalmar ...	50	...	...	...	...	...	...	...	...	...
		Port Said	213	...	...	...	...	...	...	...	...	...
"Cathay" ...	April 4	Colombo	200	229	...	...	...	...	...	...	...	...
		London	1,857	...	...	...	...	...	...	...	...	...
"Berrima" ...	April 5	London ...	14,641	27	836	...	...	...	...	...	...	...
		Hull ...	4,108	...	26	...	...	...	...	...	...	...
"Hobson's Bay"	April 8	Colombo	443	451	6	...	...	...	...	...	...	...
		Port Said	247	206	51	...	...	...	...	...	...	...
		Hull	9,467	...	...	...	...	...	...	...	...	...
		London ...	19,136	1,349	2,156	...	...	...	...	...	...	...
"Justin" (Albany)	April 14	Hamburg	18,440	...	155	...	...	...	...	...	...	...
"Gascoyne" ...	April 9	Batavia ...	50	50	...	...	...	...	...	...	...	...
		Sourabaya	50	50	...	...	...	...	...	...	...	...
		Singapore	814	760	...	...	...	...	...	...	...	...
"Oronsay" ...	April 12	Colombo	662	500	...	...	...	...	...	...	...	...
		Calcutta	50	...	...	...	...	...	...	...	...	...
		Madras ...	50	...	...	...	...	...	...	...	...	...
		London ...	5,480	227	285½	...	...	...	...	...	...	...
"Barrabool" ...	April 19	London ...	13,278	...	2,720	...	...	...	...	...	...	...
"Mooltan" ...	April 18	Colombo	150	...	...	...	...	...	...	...	...	...
"Justin" ...	April 19	Hamburg	18,477	...	...	...	...	...	...	...	...	...
		Stockholm	100	...	...	...	...	...	...	...	...	...
		Bremen ...	5,170	...	...	...	...	...	...	...	...	...
		Gottenburg	500	...	...	...	...	...	...	...	...	...
		Norkopping	100	...	...	...	...	...	...	...	...	...
		Port Said	250	...	...	...	...	...	...	...	...	...
		Copenhagen	1,056	...	...	...	...	...	...	...	...	...
"Minderoo" ...	April 26	Singapore	1,006	991	30	...	...	...	...	...	...	...
		Batavia ...	...	...	31	...	...	...	...	...	...	...
"Banffshire" ...	April 23	Port Said	361	...	...	...	...	...	...	...	...	...
		Port Said	150	...	...	...	...	...	...	...	...	...
"Esperance Bay"	April 21	Hull ...	2,535	...	...	...	...	...	...	...	...	...
		London ...	25,780	1,414	1,083	...	...	...	...	...	...	...
		Colombo	736	495	...	...	...	...	...	...	...	...
"City of Sparta"	April 22	Sourabaya	1,418	150	...	...	5	...	...	...	...	...
		Samarang	40	5	...	...	...	...	...	...	...	...
		Batavia	539	140	...	...	...	...	...	...	...	...
		Singapore	2,471	777	...	...	8	...	...	...	...	25
"Osterley" ...	April 26	London ...	502	...	...	...	...	...	...	...	...	...
		Colombo	568	409	...	...	...	...	...	...	...	...
		Madras ...	50	...	...	...	...	...	...	...	...	...
		Calcutta	50	...	...	...	...	...	...	...	...	...
"Moreton Bay"	May 5	Colombo	361	175	...	...	...	...	...	...	...	...
		Port Said	1,100	...	...	...	...	...	...	...	...	...
		London	18,731	...	435½	...	...	...	...	...	...	...
"West Hanaker"	May 5	Bombay...	500	...	...	...	...	...	...	...	...	...
		Colombo...	70	...	...	...	...	...	...	...	...	...
Grand Total	...	...	464,283	34,999	26,059½	138	95	9	70	412	7	25

526,097½

GUERNSEY RECORDS.

A correspondent from Group 78 forwards us an excerpt from the "Overseas Daily Mail," of April 2nd, 1927, in which is featured a famous Guernsey cow responsible for the production of 2,000 gallons of milk in one year. "Tregye Maze," as the cow is called, was bred by Lady Margaret Boscawen, and is now 7½ years old, and was Champion in the Royal Cornwall Show in 1925. She is now the property of Lt.-Col. E. H. W. Bolitho, of Trengwainton, Penzance, and last year gave 20,525½lbs. of milk (2,052 gallons). This is said to be a Guernsey pedigree record, not only for England but for the Channel Islands, and the animal is the first cow of any breed in Cornwall to reach the 2,000 gallon mark; moreover it is more than probable that "Tregye Maze" is a world record breaker. A remarkable fact about her heavy yield was the richness of her produce as confirmed in periodical tests by the Cornwall Milk Recording Society. The total yield of butter fat in the milk was 1,089.8lbs., equivalent to 1,362lbs. of butter, an amount which exceeded the cow's own weight by 321lbs.

Singularly enough the "Hawkesbury Agricultural College Journal" of New South Wales for the same month, published April 30th, claims a world's record for butter production for a Guernsey cow in "Parson's Red Rose XX. of Wollongbar," which has just yielded 17,252½lbs. of milk and 1,081.175 lbs. of butter fat in 365 days, which, on the basis of 83lbs. of butter fat to 100lbs. commercial butter, represents 1,302.62lbs. butter. It will be seen that the Penzance cow has topped this record by 3,273lbs. milk, 8,625lbs. butter fat, and 59.38lbs. commercial butter. The claim for the Wollongbar cow was based on a statement issued by the American Guernsey Cattle Club published in "Hoard's Dairyman" in March last, prior to the recorded production of "Tregye Maze" and "Parson's Red Rose XX. of Wollongbar." At that date the world's record for a Guernsey was held by "Silverwood Diana" on a production of 20,066.4lbs. milk and 974.8lbs. of butter fat in 365 days, a result in milk 459.1lbs. and butter fat 115lbs. lower than the Cornwall Champion, and 2,814.1lbs. milk better than the Wollongbar cow's production, but 106.375lbs. lower in butter fat—a very significant factor. The American Champion, "Silverwood Diana," was owned by a Mr. William H. Williams of New York.

"Parson's Red Rose XX. of Wollongbar" was born March 6th, 1920, and is the fourth Guernsey at the Wollongbar Experiment Farm to yield 1,000lbs. commercial butter in a year, and achieved this feat in two periods of lactation, and when only 4 years and 8 months old at the commencement of the test yielded 14,870lbs. of milk, which, at an average test of 5.8 per cent., equalled 867.96lbs. butter fat or 1,045.74lbs. commercial butter.

It is of more than passing interest to note that we have a brother of this cow, known as "Rose Chief of Wollongbar," in the herd at Denmark State Farm, and it may be pointed out as indicative of the prepotency of this strain, that the bull in question has 20 daughters which have an increased

production over their dams of results ranging from 88lbs. to 157lbs. of butter, as shown by the table hereunder taken from Bulletin No. 182 of the Department of Agriculture of W.A., "Bulls and Butter," by P. G. Hampshire, H.C.D., Superintendent of Dairying—

TABLE IV.

WHAT ONE BULL BEING USED HAS DONE.

Guernsey Bull "Rose Chief of Wollongbar," Reg. No. 130 G.H.B.

Official Production Results of 20 (all) tested Daughters compared with their Dams.

Dams.			Daughters.			Increase.	
No.	Particulars.	Butter.	No.	Particulars.	Butter.	Butter.	Per cent.
		lbs.				lbs.	lbs.
12	Tested on 1st Calf—Average	260	19	Tested on 1st Calf—Average	348	88	33·8
7	Tested up to five years Average	306	11	Tested up to five years Average	463	157	51·3
12	Tested on 1st Calf—Average	260	12	Daughters of these Cows on 1st Calf—Average	372	112	43·0
7	Tested up to five years—Average	306	7	Daughters of these Cows tested up to five years—Average	445	139	45·4
1	Not tested	...	1	Daughter tested at 4 years	608	...	...
19	Average Production of Dams	277	31	Average Production of Daughters	399	122	
19	Average Fat Test of all Dams...	% 5·12		Average Fat Test of all Daughters	% 5·82	% ·70	13·6

Note.—Since going to press another American claimant appears in "Hoards Dairyman," eclipsing all the foregoing results. "Anesthesia Faith," of Hillstead, a Guernsey cow, is credited with producing 19,741.9 lbs. of milk, containing 1,125 lbs. of butter fat, in 365 days.—Ed.

BREEDING CALENDAR.

In response to a number of inquiries received from subscribers to the Journal of the Department of Agriculture, the following Breeding Table has been prepared for publication by Mr. P. G. Hampshire, the Superintendent of Dairying:—

BREEDING CALENDAR.

TABLE OF SERVICE AND DUE DATES.

Contributed by Dairy Branch.

Day of Service.		Mare, 48 weeks (336 days).	Cow, 40 weeks (280 days).	Ewe and Goat, 21 weeks (147 days).	Sow, 16 weeks (112 days).	Bitch, 9 weeks (63 days).	Goose, Turkey, Duck, 4 weeks (28 days).	Fowl, 3 weeks (21 days).
January	1	December 2	October 8	May 29	April 22	March 4	January 29	January 22
,,	7	8	14	June 4	28	10	February 4	28
,,	14	15	21	11	May 5	17	11	February 4
,,	21	22	28	18	12	24	18	11
,,	28	29	November 4	25	19	31	25	18
February	4	January. 5	November. 11	July 2	May 26	April 7	March 4	February 25
,,	11	12	18	9	June 2	14	11	March 4
,,	18	19	25	16	9	21	18	11
,,	25	26	December 2	23	16	28	25	18
March	3	February 1	December 8	July 29	June 22	May 4	March 31	March 24
,,	10	8	15	August 5	29	11	April 7	31
,,	17	15	22	12	July 6	18	14	April 7
,,	24	22	29	19	13	25	21	14
,,	31	March 1	January 5	26	20	June 1	28	21
April	7	March 8	January 12	September 2	July 27	June 8	May 5	April 28
,,	14	15	19	9	August 3	15	12	5
,,	21	22	26	16	10	22	19	12
,,	28	29	February 2	23	17	29	26	19
May	5	April 5	February 9	September 30	August 24	July 6	June 2	May 26
,,	12	12	16	October 7	31	13	9	June 2
,,	19	19	23	14	September 7	20	16	9
,,	26	26	March 2	21	14	27	23	16
June	2	May 3	March 9	October 28	September 21	August 3	June 30	June 23
,,	9	10	16	November 4	28	10	July 7	30
,,	16	17	23	11	October 5	17	14	July 7
,,	23	24	30	18	12	24	21	14
,,	30	31	April 6	25	19	31	28	21

BREEDING CALENDAR—*continued.*

TABLE OF SERVICE AND DUE DATES—*continued.*

Day of Service.	Mare, 48 weeks (336 days).	Cow, 40 weeks (280 days).	Ewe and Goat, 21 weeks (147 days).	Sow, 16 weeks (112 days).	Bitch, 9 weeks (63 days).	Goose, Turkey, Duck, 4 weeks (28 days).	Fowl, 3 weeks (21 days).
July 7	June 7	April 13	December 2	October 26	September 7	August 4	July 28
				November			August
,, 14	14	20	9	2	14	11	4
,, 21	21	27	16	9	21	18	11
		May					
,, 28	28	4	23	16	28	25	18
August 4	July 5	May 11	December 30	November 23	October 5	September 1	August 25
			January				September
,, 11	12	18	6	30	12	8	1
				December			
,, 18	19	25	13	7	19	15	8
		June					
,, 25	26	1	20	14	26	22	15
September 1	August 2	June 8	January 27	December 21	November 2	September 29	September 22
			February			October	
,, 8	9	15	3	28	9	6	29
				January			October
,, 15	16	22	10	4	16	13	6
,, 22	23	29	17	11	23	20	13
		July					
,, 29	30	6	24	18	30	27	20
October 6	September 6	July 13	March 3	January 25	December 7	November 3	October 27
				February			November
,, 13	13	20	10	1	14	10	3
,, 20	20	27	17	8	21	17	10
		August					
,, 27	27	3	24	15	28	24	17
November 3	October 4	August 10	March 31	February 22	January 4	December 1	November 24
			April	March			December
,, 10	11	17	7	1	11	8	1
,, 17	18	24	14	8	18	15	8
,, 24	25	31	21	15	25	22	15
December 1	November 1	September 7	April 28	March 22	February 1	December 29	December 22
			May			January	
,, 8	8	14	5	29	8	5	29
				April			January
,, 15	15	21	12	5	15	12	5
,, 22	22	28	19	12	22	19	12
		October			March		
,, 29	29	5	26	19	1	26	19

RESULTS FROM FEEDING SILAGE IN WESTERN AUSTRALIA.

G. K. Baron-Hay, B.Sc., Agric.,
Assistant Superintendent of Dairying.

Last March, the Northam Agricultural Society held its Annual Competition for the Cup presented by Dr. Aberdeen and Mr. T. H. Wilding for the best Silage made in that district.

The Superintendent of Dairying (Mr. P. G. Hampshire), who acted as judge, was requested to take the following points into consideration when presenting the awards:—.

Suitability, quality, absence of mould and waste, structure of silo, condition of the stock fed, the method of feeding, the site and the neatness of the surroundings.

This is the second year since the Northam Society inaugurated this Competition, and their action may be recommended to other Societies, situated in districts where silage is considered to be of advantage to stock owners. Since the Competition last year, some 700 tons more of silage have been made, bringing the total for the district up to about 1,600 tons. It is not, of course, suggested that this increase is entirely due to such a Competition, though it is undoubtedly a factor in bringing the value of silage before farmers.

In 1926 the Cup was won by Messrs. Wood and Aberdeen. This year the successful competitor is Mr. E. McManus, with 85 marks out of a possible 100, closely followed by Mr. D. E. Morgan, with 84, and Mr. W. G. Spencer, with 83 marks.

As methods of making the silage, handling, and feeding varied with almost each competitor, it was felt that a useful purpose would be served by ascertaining, from all those farmers in Western Australia using silage, their methods of making, using, and their experience with it. A Questionnaire, therefore, was sent to all farmers known to be users of silage, and the following information has been abstracted from the replies received:—

THE CROP.

Undoubtedly, the crop which has given the best result is a mixture of oats and peas, using 1½ bushels of oats per acre and one bushel of peas.

Difficulty has been experienced in a crop sown with the above mixture, owing to the fact that, during the first few months of the life of the crop, oats grew more rapidly than the peas, and resulted in smothering the peas altogether .

The plan of sowing the oats and the peas separately on adjacent strips of land has been suggested, and may commend itself to some farmers. At cutting time, the loads may be mixed, and, during the process of chaffing, elevating and trampling, would become thoroughly mixed with each other.

Lachlan or Burt's Early Oats is preferred to Algerian.

Good results have been obtained with vetches in place of peas, sowing ½-¾ bushel per acre. Vetches are supported by the cereal plants, and also have the further advantage of ripening about the same time as the oat crop; they are also rather easier to handle with the binder.

COST OF SILAGE.

As the cost of growing a poor crop is the same as for a heavy yielding crop, the cost of silage will vary considerably with the quality of the crop grown. This was very noticeable in the costs submitted. No less than 22 farmers were able to supply a figure for the cost of silage on their farms, which, combined with the yield of the particular crop ensiled, demonstrates this difference in cost conclusively.

Illustration I.
Filling a trench silo at Mr. J. M. McDonald's Farm, Tinkurrin.

INFLUENCE OF WEIGHT OF CROP ON COST OF SILAGE.

	Tons.	Tons.	Tons.
Weight of Green Fodder per acre	7-8	6	3 4½
Average Cost of Silage per ton from figures received	8/-	11 8	15/

The average cost of silage from all sources was 10s. 11d. per ton.

The cost given above includes all charges, except those of depreciation of silos used, and interest on capital outlay of silos, and cutters and blowers for filling.

It was thought preferable not to include these charges, as the type of silos in use varied, and not all silo users possess a cutter and blower. To allow for interest on capital outlay at 7 per cent., it will be necessary to add 3/5d. per ton where the equipment consists of two concrete silos of 85 ton capacity each, costing £320, and a blower costing £100.

WASTE.

The waste in making and utilisation of silage is dependent on three factors:—

1. The type of silo.
2. Method of covering the silage when the silo is full.
3. Time of feeding.

1. *Type of Silo.*—Silage is made by three methods in this State—

(a) Overhead tub silos.
(b) Trench silos.
(c) Stack silos.

and all types were represented in the returns received.

The relative amount of waste found in making silage by each of these three methods is as follows, with 80 tons of silage in each case:—

	Waste.
Overhead Silo	3.3 per cent.
Trench Silo	7.0 „
Stack Method	20.0 „

With small stacks, the loss may be as high as 30 per cent.

Where finances will not permit of the overhead silo being built, the writer strongly recommends the adoption of the Trench Silo, fully described in the September, 1924, issue of this *Journal.*

2. With the overhead silo, where the waste is mainly in the top foot or so, some farmers eliminated this waste almost entirely, by laying flat sheet-iron or bags on the surface of the silage, and covering this with petrol tins, filled with sand. Mr. D. E. Morgan, Northam, maintains that the saving of silage by this method is well worth the labour entailed.

The wastage may be reduced to about 2 per cent. by scattering a layer of oats (2in.), on top of the silage, and damping same to cause germination.

The same result may be obtained by blowing on to the top of the silage about 6in. of chaff, and damping the same. The resulting growth of mould forming an effective seal.

An 85-ton silo would require, approximately, 5½ bushels of oats to form a layer 2in. thick and the writer is doubtful if the silage saved warrants the expenditure.

Thorough tramping while the silo is being filled, is, of course, always necessary.

3. Cattle (fed in the open), and sheep waste less silage if the troughs are filled in the late afternoon, instead of in the morning. By filling during the heat of the day, evaporation rapidly takes place, stock do not relish the silage and the benefit of moist food is lost.

Mr. N. Davis, Gnowangerup, who feeds unchaffed silage made in trenches, to sheep, has found that sprinkling the long material with molasses (1lb. of molasses to a kerosene tin of water), induces the sheep to eat the material more readily and there is but little waste.

METHOD OF FEEDING.

The method most in vogue in the handling of silage is to empty the silage down a chute—made to fit the silo door—into a waiting cart.

An ingenious device is used by Mr. Morgan, at Northam. The frame of the chute fitting the door is hinged to a strong piece of jarrah boarding, 3in. x 1in., so that the flat side of the board would rest against the upright of the door; this is held in position with two D clamps. The whole frame may thus be easily moved from door to door, as the material sinks in the silo, and the chute may be swung out of the way when one enters the door.

Two types of feeders are in use for sheep:—

(a) Bag troughs. (Illustration II.)

(b) Troughs made from kerosene tins.

Illustration II.

Bag trough as used by Messrs. Wood & Aberdeen, Northam. These should have a wire strained inside the trough at the bottom, and on each side, to prevent "flapping" by wind.

The latter, shown in Illustration III., are preferable as being permanent, easily moved, and the sheep cannot fall into them, as they do in the bag feeders, and are unable to get up. A convenient size for these feeders is shown in the illustration, where the construction is seen to be simple. Each feeder, as shown, is sufficient for 20 sheep.

It is not advisable to feed a large number of ewes with young lambs in one enclosure. Several farmers have observed that the ewes lose their lambs in the crush to reach the silage, as may be imagined by a glance at Illustration IV. Two hundred in one enclosure is a convenient number.

RESULTS FROM FEEDING MILCH COWS.

Eight farmers, from whom information was obtained, had fed silage to milking cows, with unqualified success. Two, however, stated that the results from their milking cows had not come up to their expectations, but in each case silage alone had been fed to the cows without any outside concentrate. This result might be expected when the composition of silage is considered. Silage contains 71-75 per cent. water and, if made from the cereal crops alone, cannot supply the protein and starch requirements for a dairy

cow, in the ration which a cow can digest daily. The same, of course, would apply to ewes and suckling lambs, though to not so great an extent, as the milking function has not been artificially stimulated by selection and breeding, as in the milch cow.

The feeding value of silage was dealt with in detail by the writer in the December, 1924, issue of this Journal, a portion of which article is now quoted:—

> "The writer has noticed, while travelling throughout the State, that there is a tendency among farmers to over-rate the value of silage in a ration—in fact, to regard silage as a complete ration in itself, the possession of which will solve all feeding difficulties."

Illustration III.

Feeders made from kerosene tins, Mr. D. E. Morgan, Northam.

The following Table gives average results of analyses of silage made from the crops in common use in this State. The amounts of digestible nutriments only are given, the indigestible portion being omitted:—

COMPOSITION OF SILAGE FROM DIFFERENT CROPS.

	Total Dry Matter.	Digestible Nutrients in 100lbs.				Nutritive Ratio. 1
		Crude Protein.	Carbo-hydrates.	Fat.	Total.	
Maize	26·3	1·1	15·0	0·7	17·7	15·1
Oats	28·3	1·5	13·8	0·9	17·3	10·5
Oats and Peas ...	27·5	2·8	12·6	1·0	17·6	5·3

On perusing this Table, it will be seen that the difference between the three samples is mainly in the crude protein or flesh-forming nutrients. An oat and pea silage contains 2½ times as much digestible crude protein as that made from maize, and it is mainly to this difference that as good results as might have been expected have not been obtained where silage alone has been fed to stock, particularly if made from cereal crops alone.

Illustration IV.

Feeding with bag troughs. F. E. Weyman, Bencubbin. Under these conditions sheep may lose their lambs.

A comparison of a standard ration with one of 45lbs. of cereal silage per day, fed to an 800lb. cow producing three gallons of 4 per cent. milk per day, shows this clearly:

	Total Dry Matter.	Digestible Nutrients in 100lbs.				Nutritive Ratio. 1
		Crude Protein.	Carbo-hydrates.	Fat.	Total.	
Maize Silage—45lbs.	11·8	0·49	6·75	·31	8·23	15·1
Oats Silage—45lbs.	12·7	0·67	6·21	·40	7·78	10·5
Standard Ration ...	25·30	2·32	14·86	·50	18·31	6·8
Deficiency (approx.)	13·18	1·74	8·38	0·15	10·31	...

The comparison shows that, when silage made from cereals only is fed to cattle, the animals would have difficulty in consuming enough to supply the dry matter necessary to maintain health and produce milk, *i.e.*, about 25lbs., and even then the flesh-forming nutrients would be deficient.

Those farmers who supplemented silage with a dry roughage and a nitrogenous concentrate, *i.e.*, bran, invariably have obtained good returns.

The following results, which have been extracted from the Official Herd Testing Records of Messrs. A. W. Padbury, Koojan; D. Malcolm, Wagin; and E. McManus, Northam, show the value of silage for the feeding of milch cows.

FEEDING VALUE OF SILAGE.

Compiled from the Records of the Pure Breeds Herd Testing Scheme, 1923-26:—

Total Production of all Cows for 30 Days.

	(a) Good Green Pasture, no Silage.		(b) Dry Pasture, with Silage.	
	Milk.	Butter Fat.	Milk.	Butter Fat.
Yield in lbs.	6,985·5	354·8	6,909	352·7
Percentage Yields	100	100	99	99

This Table shows that silage can maintain the milk flow, in the absence of green fodder, and is about equal to or a little better for milk production, as the cows were one month further advanced in their lactation period.

The point to notice is that, without silage in these districts, the economical production of milk in the summer months would have been impossible.

For the feeding of silage to sheep, the same principles would hold, and, if dry roughage in the nature of stubble is not available, this should be supplied by an addition of chaff. Where the silage has been made from cereal hay alone, good results have been obtained by providing in addition ¼lb. of oats per sheep per day.

A guiding rule, when feeding either cattle or sheep, is to have 3lbs. of silage and 1lb. of dry roughage per 100lbs. live weight.

Illustration V.

Silage has maintained these Pure Bred Jerseys, owned by Mr. W. G. Spencer, Grass Valley, in excellent condition during the summer.

The following rations prepared from concentrates usually found on farms, and having silage as a basis, will be a guide for those wishing to obtain the best results from feeding silage. Each ration is for a medium sized dairy cow giving three gallons of milk per day and of average test.

		Total Dry Matter.	Crude Protein.	Carbo-hydrates.	Fat.
No. 1:					
45lbs.	Silage (Maize)	11·83	·58	6·75	·31
10lbs.	Oaten Chaff	9·0	·43	4·64	·15
4lbs.	Bran	3·59	·50	1·66	·12
2lbs.	Linseed Meal	1·80	·63	·76	·06
61lbs.	Nutritive Ratio 1 : 7·1 ...	26·22	2·14	13·81	·64
No. 2:					
40lbs.	Silage (Oaten)	11·32	·60	5·52	·36
12lbs.	Wheat Straw (chaffed) ...	10·99	·09	4·21	·06
4lbs.	Bran	3·59	·50	1·66	·12
2lbs.	Linseed Meal	1·80	·63	·76	·06
58lbs.	Nutritive Ratio 1 : 7·4 ...	27·70	1·82	12·15	·60
No. 3:					
40lbs.	Silage (Oats and Peas) ...	11·0	1·12	5·04	·40
12lbs.	Oat Straw	10·62	·12	5·11	·11
4lbs.	Bran	3·59	·50	1·66	·12
1lb.	Linseed Meal...	·90	·32	·38	·03
57lbs.	Nutritive Ratio 1 : 6·6 ...	26·11	2·06	12·19	·66
No. 4:					
40lbs.	Silage (Maize)	10·52	·44	6·00	·28
10lbs.	Lucerne Hay	9·14	1·06	3·90	·09
5lbs.	Oaten Chaff	4·50	·22	2·32	·08
2lbs.	Linseed Meal	1·80	·63	·76	·06
57lbs.	Nutritive Ratio 1 : 6·0 ...	25·96	2·35	12·98	·51
No. 5:					
40lbs.	Silage (Oats and Peas) ...	11·0	1·12	5·04	·40
12lbs.	Clover Hay	10·52	·95	4·43	·13
5lbs.	Oaten Straw (chaffed) ...	4·42	·05	2·13	·05
57lbs.	Nutritive Ratio 1 : 6·1 ...	25·94	2·12	11·60	·58
No. 6:					
40lbs.	Silage (Oats and Peas) ...	11·0	1·12	5·04	·40
15lbs.	Wheaten Chaff	13·05	·19	3·70	·19
4lbs.	Bran	3·59	·50	1·66	·12
2lbs.	Linseed Meal	1·80	·63	·76	·06
61lbs.	Nutritive Ratio 1 : 5·4 ...	29·44	2·44	11·16	·77
No. 7:					
40lbs.	Silage (Oaten)	11·32	·60	5·52	·36
10lbs.	Oaten Chaff	9·00	·43	4·64	·15
6lbs.	Crushed Oats...	5·45	·58	3·12	·23
2lbs.	Linseed Meal	1·80	·64	·76	·06
58lbs.	Nutritive Ratio 1 : 7·0 ...	27·57	2·25	14·04	·80

HAND FEEDING.

The necessity for hand-feeding stock during the summer months is now being recognised by almost all farmers in this State, except in the few favoured districts where permanent pasture is possible.

Considerable difference of opinion is encountered among stock-owners as to the most economical fodders to use during these months.

Among the foods advocated are—oaten chaff (cut when green), crushed oats, bran, and silage. Of all these fodders, the only one which may be said to approximate to natural green pasture is silage.

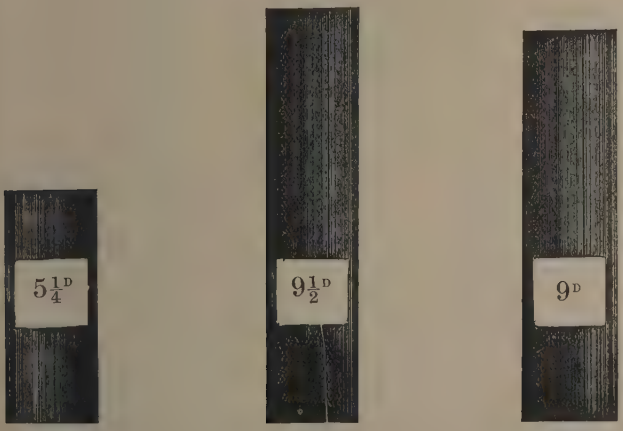
The period of hand-feeding, of course, would vary in each year and with the district in which the farm is situated. On the Wheat Belt and the Great Southern, however, 50 per cent. of silo-owners commenced feeding stock early in February and continued until silage was exhausted, usually in late May, by which time the new season's growth had commenced.

The relative cost of feeding silage, chaff or crushed oats to sheep, is shown clearly in the diagram below. To the monetary cost, however, must be added the special proved value of silage for feeding ewes during the lambing period.

For the purposes of making this comparison, silage was valued at 10s. 11d. per ton; chaff at £2 18s. ton (conservative), and oats at 2s. per bushel.

COST OF FODDER FOR 30 DAYS.

SHEEP.



SILAGE. 3lbs. day.

CHAFF. 1lb. day.

CRUSHED OATS, ½lb. day.

ECONOMIC ASPECT.

Every farmer who furnished information stated definitely that he considered silage beneficial for his particular district, the only point of difference between the answers being the degree of vehemence in favour of silage.

The following are some representative opinions received:—

J. Deane Hammond, Kellerberrin: "Every sheep or cattle owner should have a silo."

S. W. Taylor, Tambellup: "Very beneficial for early lambs."

R. J. Stewart, Northam: "Small farmers must have one, others should have more."

B. W. G. Hopwood, Bencubbin: "Sheep kept in good condition."

Bailey Bros., Denmark: "Excellent both for milk and beef."

F. E. Weyman, Bencubbin: "No lambing trouble."

H. D. Morgan, Northam: "Ewes gave more milk."

Wood & Aberdeen, Northam: "Weaners and ewes do particularly well on it."

M. O'Donnell, Katanning: "Can drop lambs at any time."

N. P. Davis, Gnowangerup, who fed 3,000 sheep last year: "Retain their spring condition in health and quality of wool."

How & Sons, Pingelly: "Sheep always in good condition."

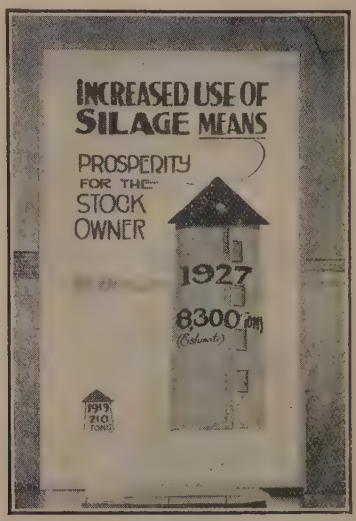


Illustration VI.

J. M. McDonald: Tinkurrin: "Without it, I would have had some 800 sheep in poor condition, with stunted lambs. With its help, I have well grown lambs, and sheep in good condition."

These few opinions from farmers who have used silage (some for several years), are respectively of the tenor of replies received and conclusively prove the value of silage for the feeding of cattle and sheep during the dry season in this State.

The value of silage does not, however, end here.

Its use, by enabling farmers to conserve fodder when plentiful, for feeding at a lean time of the year, permits of an increased number of stock being carried.

From the returns received, it would appear that by having 85 tons of silage, a farmer may reasonably expect to carry

300 *more sheep*

over the lean period (January-May), than before silage was provided. Every reader will quickly realise what this may mean in increased revenue, not only to the individual farmer, but to the State.

It is interesting to note the rapidity with which the use of silage has advanced during the last few years in this State, as shown in the diagram on opposite page, and there is every reason to believe that this rate of increase will not only be maintained, but considerably accelerated in the future.

In conclusion, the writer wishes to thank the following farmers, who have provided information used in this article:—

Messrs. A. W. Padbury, Koojan; H. D. Morgan, Northam; Wood & Aberdeen, Northam; J. Deane-Hammond, Kellerberrin; J. H. Fidock, Woodanilling; R. J. Stewart, Northam; H. Harrison, Bokal; C. Pittendrigh, Manjimup; M. O'Donnell, Katanning; S. W. Taylor, Tambellup; N. P. Davis, Gnowangerup; R. D. Simm, Highbury; How and Sons, Pingelly; D. Malcolm, Wagin; A. Piesse, Wagin; Prowse Bros., Doodlakine; J. S. Lundy, Cunderdin; D. Munro, Northam; F. E. Weyman, Bencubbin; Bailey Bros., Denmark; Narrogin School of Agriculture; Denmark Stud Farm; V. Cockram, Katanning; B. W. G. Hopwood, Bencubbin; J. M. McDonald, Tinkurrin; W. G. Spencer, Grass Valley; V. D. Pailthorpe, Kojonup; E. McManus, Northam; Avondale State Farm, Beverley; J. A. Kitto, Cunderdin.

PHYSICAL CONDITION OF SOIL.

B. L. SOUTHERN,* A.A.C.I.

A clay soil holds more water than a sandy one, but a crop will grow on less water in sand than in clay, the reasons being very apparent from Dr. Keen's researches at Rothamsted Experimental Station, and general considerations. Colloids hold a considerable amount of moisture which they refuse to give up to the plant, particularly when the wilting point is approaching, as they are fighting for it with the plants and living organisms; hence a soil containing considerable quantities of colloids will retain more water than a sandy one—in which the colloids are few—when the wilting point is reached. Plants may survive in a sandy soil containing only 5 per cent. of moisture and wilt in a clay containing as much as 15 per cent. We can, however, look at the problem from another important point of view. The plant absorbs capillary moisture, and as the thickness of the film decreases, the power of the plant to obtain its water decreases correspondingly until a stage is reached when the film is so thin that the water cannot be utilised. As the particles of clay soils have a greater surface area than those of sandy soils it stands to reason that more of this unavailable water exists in clays than in sands, hence the percentage of water is always higher in the former than in the latter when plants first show signs of lack of moisture. For these reasons in dry seasons light lands often grow better crops than heavy lands, while in very wet seasons the heavier types give the better yields because it takes much more rain to wet and maintain the heavy soil at its best capacity over a required period of growth.

Fallow and cultivation carried out at the correct times in a proper manner conserve moisture in the soil by preventing losses due to evaporation. The purposes of fallow are, however, manifold and require careful explanation. Referring to Figs. III. and IV. in the previous issue of this journal (March, 1927, p. 11), it must not be assumed that soil particles simply hang in air, as illustrated: they are in close contact with each other, the closeness depending upon how tightly they are packed or rammed. The tighter they are together, up to certain limits, the finer and more efficient are the irregular capillary channels which convey moisture from the sub to the surface soil. To prevent losses of water by evaporation it is necessary to break up the capillary connections at the surface, and it follows this can be done by increasing the distances between the particles, or, in other words, make a good mulch on the surface and keep the soil underneath consolidated. The mulch will dry quickly, due to increased air circulation between its particles, and form a light protection over the moist soil. A mulch to be efficient must be about two inches deep, light, and of open texture in which the capillary connection is bad. Some soils powder too much when mulched: under such circumstances it is better to plough and not follow up with intensive cultivation, but the ploughing must be thorough and the sods turned completely over, covering up the underneath soil and resting lightly upon it. The ideal condition for a mulch would be, of course, impossible—that is, a covering over the soil with a complete air space or cushion about one-quarter of an inch in depth between the covering and the soil. The worst condition is no mulch at all; but seeing the ideal is contrary to the law of nature known as gravity, it is necessary to do the best to approach the ideal by making as efficient an air cushion as possible. The most suitable practical condition is best determined by experiment based on theoretical considerations combined

with local climatic changes. Heavy rains readily consolidate a good fallow, thus renewing the capillary connection and destroying the mulch; the wisdom of recultivation depends entirely on local conditions; should more rain be expected, then a cultivation would appear unnecessary, but it is essential, particularly in drier districts, to restore the mulch after the last of the seasonal rains.

Light lands dry off quickly owing to the coarse particles keeping the soil open, thus allowing the air to penetrate to considerable depth and dry it out: the obvious method for treating this type is to consolidate it by rolling after ploughing, which should not be deep. When firmly pressed the surface should be lightly mulched to break up the capillary connection between the surface and under-soil.

Hard pans may exist in the subsoil, due to the cementing together of soil particles; this layer prevents the passage of air and water and should be broken up by subsoiling. Another similar condition is often brought about by ploughing at one depth over the same piece of land year after year; this condition is easily overcome by a slight variation in the depth worked to each year. The first seasonal rains usually have some difficulty in penetrating the soil, with the result valuable water runs to waste; this may be prevented by fallowing and cultivation breaking up a hardened surface and allowing the first rains to penetrate to the moist subsoil. Some patches are very difficult to wet; the trouble, if not over very large areas, may be obviated to a great extent by working in farmyard manure, the effect of which is to keep the soil open.

Wheat-farming methods employed in Western Australia do not lend themselves to an economical improvement in the physical condition of the poorer class of land; the only thing to be done is to make the best of what we have and can afford, but good methods in most cases cost little more than bad ones. Any increase in cost of improved methods of production amply repays at the end of the season. Much country would, however, give better yields, so there is any amount of room for improvement when one knows how to go about it, and to go about it one must understand fundamental principles.

Intensive agriculture provides ample scope for improving and maintaining a good physical condition of soil. Such areas are primarily selected on account of quality, their proximity to established markets, or abundant water supply. When quality is lacking wonderful results may be obtained by building up bare sand with decaying organic matter which, in the presence of lime, air and moisture, is rapidly converted to valuable humus. The light horse manure mulch used by horticulturists is an admirable one for this class of garden, keeping the soil moist and cool in summer and warm in winter.

The natural physical condition of a soil partly governs the class of crops grown but, of course, conditions may be altered to suit one particular crop. Some plants grow better in dry areas than in wet ones, but by suitable methods of cultivation and drainage the dry area crop may be grown successfully in the wet area, provided the other climatic conditions are nearly similar during the growing and ripening periods. There is an optimum amount of water suited for a growing crop, and the figure is usually expressed as so much per cent. of the water required for complete saturation: as a clay holds more water than a loam or sand, it naturally follows that the best moisture content is dependent on the percentage of saturation. The most suitable figure is from 50 to 60 per cent. Saturated sand contains about 35 per cent. of water, so the desirable amount would be 12-15 per

cent. in the original soil. Natural vegetation is adapted to particular local conditions whereby it thrives in dry or damp soils according to which, over hundreds of years, it has become accustomed. The yield of grain suffers first from a lack of moisture, it tending to form too early; with increasing water the root system develops; with too much water the leaves get large, ripening is delayed, and the root system is restricted. Wheat is not indigenous to Western Australia, so we have to cultivate it according to its native requirements; science is, however, helping the farmer by breeding wheats and other cereals suitable for district, even local requirements.

SUMMARY.

1. To bind loose soils, add humus and lime.
2. To open up heavy soils, add humus and lime or gypsum.
3. Don't work heavy soils when too wet.
4. To increase water-holding capacity, reduce the size of the particles or add humus.
5. To conserve moisture, fallow and mulch.
6. To be successful, judiciously combine theory with practice.

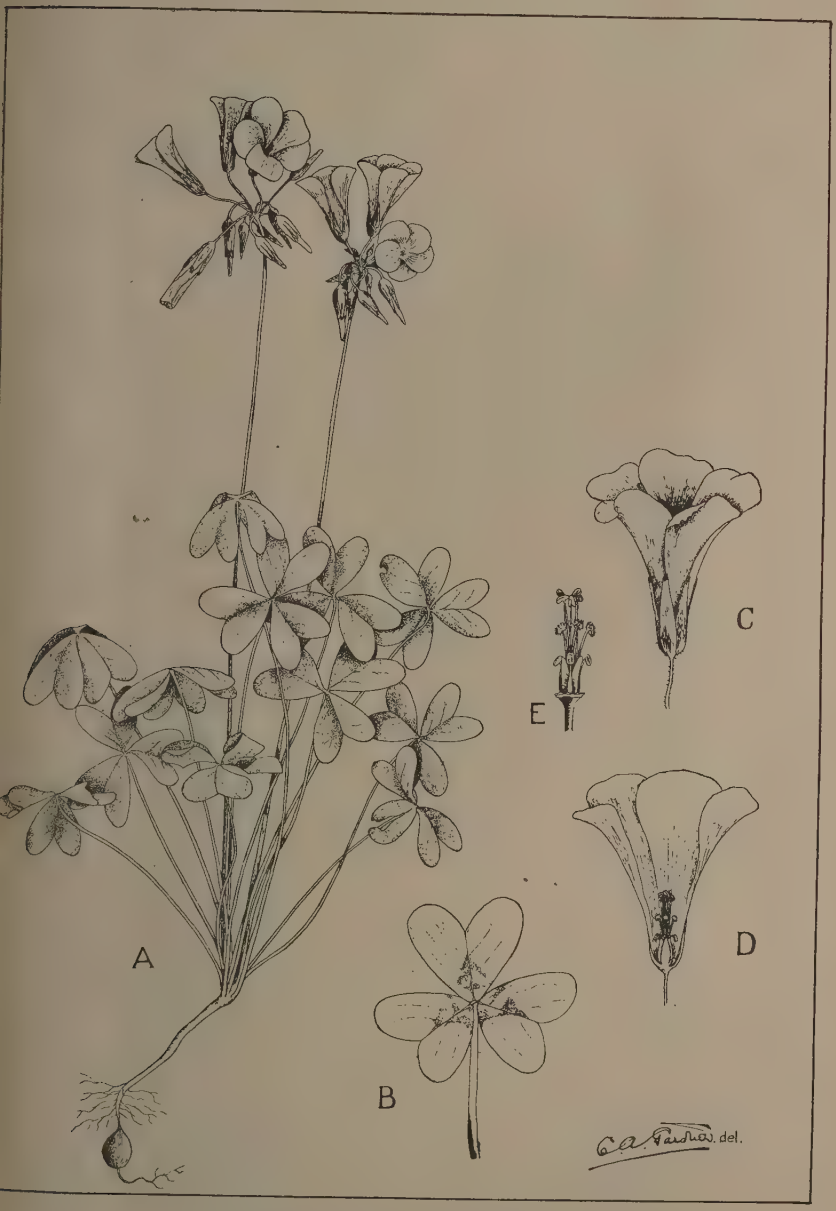
SOURSOB.

(*Oxalis cernua*, Thunb.)

W. M. CARNE, F.L.S., and C. A. GARDNER.

This plant, a native of South Africa, is a common weed of gardens and waste land around Perth and in many gardens and orchards of the coastal plain. Appearing soon after the first rains, it may flower as early as June, and continues until about October, after which, excepting in shady and moist situations, it dies down. Soursob is a herbaceous perennial. The parts of the plant which are above ground die down annually, but the subterranean parts live indefinitely. These subterranean parts consist of a fleshy root-stock and numerous small bulb-like tubers, by means of which the plants spread until they take possession over certain areas unless interfered with. The masses of yellow flowers in drooping heads arising from the stretches of clover-like leaves is a common enough sight in the metropolitan area. Although it flowers so prolifically, the plant does not appear to produce many seeds, apparently relying for the greater part on spreading through its underground parts.

Soursob is not a serious weed, and can easily be kept under control by cultivation. It is only evident during the winter and spring, and provided that it is ploughed in and the land kept clean afterwards during this period, there is little chance of it surviving more than a few seasons.



Soursob (*Oxalis cernua*, Thunb.).

DESCRIPTION OF PLANT.

A pubescent perennial plant, almost glabrous, stemless, the rootstock producing numerous bulb-like tubers with a brown coat, and white spindle-shaped tubers. Leaves all radical, consisting of three clover-like leaflets on a long stalk, the leaflets almost wedge-shaped, or inverted heart-shaped, green with purple-brown markings. Flowers in umbels with long stalks, drooping, yellow, 3 to 16 in the umbel. Sepals small, lanceolate, with two orange-coloured swellings at the tip; petals about 1 inch long. Capsule oblong and pointed, but rarely maturing.

For further details see plate.

EXPLANATION OF PLATE.

A, Plant; B, Leaf; C, Flower; D, Section of Flower; E, Stamens and Pistils.

CABBAGES.

J. C. PALMER (Dip. Agric.)—Potato Inspector

The cabbage is one of the most popular vegetables grown in the garden or in the field. Besides being an excellent food for human consumption, it is well liked by stock and poultry, and will grow easily in most classes of soil with but comparatively little preparation of the ground. Cabbages can be grown all the year round in certain localities if necessary, but as a general rule the gardener arranges to plant out his seedlings in the months of May, June, and July, although a summer planting is made in the southern portions of the State, and is generally most profitable.

RAISING OF SEEDLINGS.

The best method of raising plants is to sow the seed in drills in the seed bed, allowing about four inches between the rows. The seed should be distributed thinly, and each ounce will sow a length of about 200 feet. Another computation is one quarter pound of seed, which will furnish enough seedlings to plant an acre. Some growers broadcast the seed, but this is not a good practice, for it is not possible to weed the seed bed at all properly after such a method of sowing. A good type of seed bed is one about five feet wide; this will allow of it being weeded easily from each side. If the seed be broadcasted, a bed 20 feet long by 4 feet wide should grow enough seedlings to plant an acre. In planting a seed bed it is better to allow for more plants than will be needed, to counterbalance the loss of plants by possible insect attack and diseases.

The chief consideration is the raising of sturdy plants which will stand the transplanting later on. Some growers prefer to raise seedlings on somewhat poor soil, so that when these reach a height of about three to six inches their growth will be somewhat checked, thus enabling the gardener to have his plants in the field as uniform as possible. Give plenty of light to the seedlings, to encourage growth and to minimise the possibility of raising sickly or disease-infected plants, and to avoid "legginess," which occurs if grown in a shady position.

TRANSPLANTING AND GENERAL CULTIVATION.

The main plot for the cabbages should be a rich, well prepared soil. Soils supplied with humus, or rich alluvial soils, do not need such heavy manuring, but it is always well to remember that cabbages are very gross feeders. In the case of poor lands the grower should plough or dig in well-rotted farmyard or stable manure, and, where this manure is not available, artificial nitrogenous manures must be used. In any case, better results are obtained when both are properly combined.

A good artificial manure is blood and bone and superphosphate, applied at rates of not less than 6 cwt. per acre. Cabbages will always respond to a top-dressing of either nitrate of soda or sulphate of ammonia (at the rate of 1 cwt. per acre), especially when the "heads" are just beginning to form. These manures (nitrate of soda and sulphate of ammonia), contain nitrogen, which tends to produce leaf growth in plants of any description.

The surface of the ground should be made firm and the plants planted out in rows. The large commercial cabbage is planted about 30 inches between the rows, and about 24 inches between the plants. Naturally, if one of the smaller varieties is grown, the distances can be reduced. If the soil be of poor quality, however, the plants must be given more room and planted three feet by three feet. On very rich soils the distances can be made rather less than 30 inches by 24 inches to prevent tendency of the cabbage growing too large. Very large "heads" are not desirable from a housekeeper's standpoint, and so should be avoided.

When transplanting, it is advisable to see that the soil is firmly pressed down all round the planted seedlings, and a watering at this stage is most beneficial. Some growers, when dealing with very healthy and well developed plants, cut part of the main root before transplanting into the main plot. When the planter does not grow his own seedlings, he should not keep the plants obtained from the seedsman too long out of the ground.

During the growing period the cabbage must not receive any check in its growth. The best cabbages are those which have grown quickly and steadily, and the grower should aim at producing solid, compact and sizeable cabbages.

Cabbages have been grown successfully in virgin bulrush swamps. The bulrushes are cut down and either burnt where they fall or else collected in heaps. Lines are stretched across the swamps to mark out the rows, which should be three feet apart. Every two feet along the lines holes are made with a mattock; a pinched handful of fertiliser is worked into the hole, and in each a seedling cabbage is planted. One would naturally plant cabbages in this manner from about the middle of December to the middle of January, in order to minimise the chance of having the plot flooded out. When

setting out the rows it is advisable to have a track of about six feet for every 30 rows to enable the cabbages to be taken out of the swamp. This is a method which has been successfully applied by a well-known grower in the Albany district.

HARVESTING.

Cabbages are ready for cutting when the heart is fully developed and does not yield to pressure from the hand. Most growers cut the cabbages and leave the stumps in the ground, but it is better to pull the whole plant and cut off the head afterwards. The stump, left in the ground, uses up plant food, besides forming a refuge for insect pests. If the stumps are pulled when the cabbages are cut, it is advisable to collect them into heaps and burn them. Prevention is always better than cure, and pests accumulate in rubbish.

When harvesting cabbages in low-lying or swampy land, the following method of dealing with the crop will be found useful: A wooden tram track is laid; this is constructed out of 3in. x 2in. jarrah, made up in sections of 10 feet to 12 feet, nailed to three sleepers of 9in. x 1in. timber. Each section is allowed to overlap the previous one. The rails should be 20 inches apart. A truck with an ordinary flat top, on to which fits a four-sided detachable crate and fitted with four flanged wheels, is used to cart the cabbages off the swamp to a place more suitable for packing. This method, practised by a grower in the Narrikup area, is very satisfactory, and is much more economical than carrying the cabbages out in a horse and cart.

The best method of packing is as follows:—During the harvesting of the cabbages, bags are suspended beneath a tripod carrying a pulley block at the top. On the rope extending from the pulley is a hoop with four spikes, and to these the top of the bag is attached. The bag is swung clear of the ground and tightly packed. The average weight of bags of cabbages varies from 140 to 160 lbs.; this weight, of course, depends on the size of the cabbages; meduim sized cabbages will average 25 to the bag, whereas large cabbages may only average 18 to 22. The price obtained for them must vary considerably, but if a mean price, taken over a period of seasons, is considered, this crop will show a fair margin of profit. Sometimes the market is so glutted with cabbages that a very low price is obtained, which does not yield a profit to the grower. At a time when cabbages have been scarce, they have been sold at 50s. per cwt., but the average return will be found most payable.

VARIETIES.

A few of the most popular varieties are:—

Enfield Market } Two old established and reliable
Henderson's Succession } varieties.
Champion Ox.
Yates Early Drumhead.
Brunswick.

LAMB-MARKING.

Cleanliness Essential.

Hugh McCallum,
Sheep and Wool Inspector.

The lambing is a busy time for the sheep farmer. The percentage of lambs raised will depend largely upon the care bestowed on the flock during lambing and the successful method of marking. It is necessary that the young males should be emasculated, and both sexes tailed, upon reaching a suitable age. The age ranges from a few days old to four or five weeks. In small flocks the breeder can use his discretion and mark his lambs at the age he considers must suitable—the earlier the better.

The safest time to choose for lamb-marking is cool, dry weather, and the lambs should not be overheated. Marking in cold, wet weather is very trying on lambs. Numbers often die when marked under such trying conditions.

The process of castration is easily learnt. Cleanliness in tools used is important: see that ear-markers and knives are properly disinfected. This is most important, as losses often take place at lamb-marking through blood poisoning. The operations should be performed in the following order: (1) ear-marking; (2) castrating; (3) tail-docking. The catcher should be quick, yet careful, in handling the lambs, and should grip their legs firmly but not too tightly, placing the lamb on its rump on the rail of the yard, the back of the lamb resting against the catcher's chest. On no account allow the legs to be pulled too far apart, as this often injures the limbs.

After the ear-marking the operator takes the tip of the purse firmly between the thumb and first finger of the left hand and, with a sharp knife in the right hand, cuts about half an inch off the purse, or scrotum, just enough to allow the testicles to be grasped by the teeth. They should be drawn as gently as possible without any biting or breaking, and both should be drawn together, assisting at the same time with your fingers and thumb. With practice it becomes easy work.

In the event of one testicle failing to come up after pressure, do not waste time in bruising the lamb's crutch. Do not cut the tails from these lambs, as later you will know them by their tails. The operation may then be completed, failing which do not allow these sheep to run among your ewes. Swab the quarters and the cuts with a good solution of disinfectant. Suitable disinfectants are supplied by all stock agents, and no farmer should be without them. Care should be taken to prevent the entry of the solution used into the purse.

The tailing process is simple, yet I have seen bad workmanship on many farms, lambs' tails being cut off at the third and fourth joint. The tail is seized in one hand, and should be cut off at the second joint from the rump. The joint can easily be found by pressing the tail between the forefinger and thumb of the left hand. Care should be taken that the skin of the tail is not pulled tightly forward so that an unsightly stump of the tail bone is shown after the cut. When the lamb is released after marking the catcher should see that it drops on all four feet; this can be done by releasing the two

hands simultaneously. Do not drop the lamb on its rump; this careless method often means a broken leg. After the marking is completed it is necessary that the flock be kept well in hand until all the lambs have been mothered. If there is no attempt at mothering there is often loss of motherless lambs. This should be avoided at all cost. After the marking is over the tails should be counted and the percentage obtained.

Tetanus is one of the greatest dangers to be guarded against in lamb-marking. Very high mortality is often caused in this operation by neglecting to take ordinary precautions. Examine the lambs occasionally to see that the cuts have not been fly-blown.

FRUIT-FLY (Ceratitis capitata). A Big Capture—15,000 Fruit-flies.

L. J. NEWMAN, F.E.S.,
Entomologist.

With a vew to further demonstrating the effectiveness of trapping or luring as a valuable adjunct to foliage baiting a test was made in a suburban garden. Five orange-trees were selected, and into each tree two open slip-lid tins were placed.

The lure used was the following: pollard 8 ozs., powdered borax 8 ozs., and water one gallon. The ingredients were thoroughly mixed and allowed to steep in water for twelve hours. At the end of this period the whole was well shaken together and allowed to settle. When settled the clear amber-coloured liquid was drawn off and used in the tins. The thick residue was thrown away. By using only the clear liquid the clogging of the traps is prevented. The lure was renewed every seven days.

The test was for one month, commencing mid-April and terminating mid-May.

The capture in the ten traps was astonishing, no less than 15,000 flies being recorded.

In our efforts to control this pest much good work could be accomplished by a continuous campaign. Unfortunately most growers fail here. On the advent of the rains and winter weather they cease to take any further action against the fruit-fly. It is not until the stone fruits in the early summer become infested that the average grower again awakens to the fact that the fly is on the war-path.

I desire here to reiterate the often-repeated statement that we have an active generation of this pest throughout the year. The fly in the main depends on the over-wintering adults to carry it through to the early stone fruits.

Trapping and foliage baiting should be continued throughout the winter and spring whenever weather conditions will permit. Every fruit-fly captured or poisoned during this period is reducing the carry-over strength of the pest.

Jar containing 15,000 captured Fruit Flies.

SUMMER FODDER CROP COMPETITIONS.

P. G. HAMPSHIRE,
Superintendent of Dairying.

As the result of the public-spirited actions of Mr. McCallum Smith, proprietor of the "Sunday Times," the Directors of Westralian Farmers, Ltd., Mr. William Padbury, and Hon. J. M. Macfarlane, M.L.C., offering trophies, Summer Fodder Crop Competitions were conducted in the South-West, principally among group settlers.

These competitions were inaugurated with the object of encouraging group settlers and others to supplement their pastures with green fodder crops during the summer months, and were conducted in conjuction with the Royal Agricultural Society, the judging of the crops being carried out by Field Officers of the Dairy Branch of the Department of Agriculture.

Four prizes—Single Row Maize Planters—were donated for winners in the following group settlement areas:—

1. Peel and Bateman Estate.
2. Busselton-Augusta.
3. Manjimup-Pemberton-Northcliffe.
4. Denmark.

A prize of a single row maize planter was offered to the group settler in each of the four districts—in the charge of a field supervisor—producing the greatest weight of fodder on one acre as the result of growing maize, sorghum, and sudan grass, the whole acre to be planted with one of these crops or with two or more of them; in the latter case each crop to be planted distinct from the other. All crops to be planted in drills three feet apart.

The competing crop or crops were judged according to the following scale of points: yield, as determined by weighing an average portion of the crop, 40 points; evenness of growth, 15; uniformity of planting, 15; freedom from weeds, 15; character of cultivation (as indicated by the condition of the soil, 15; total, 100 points.

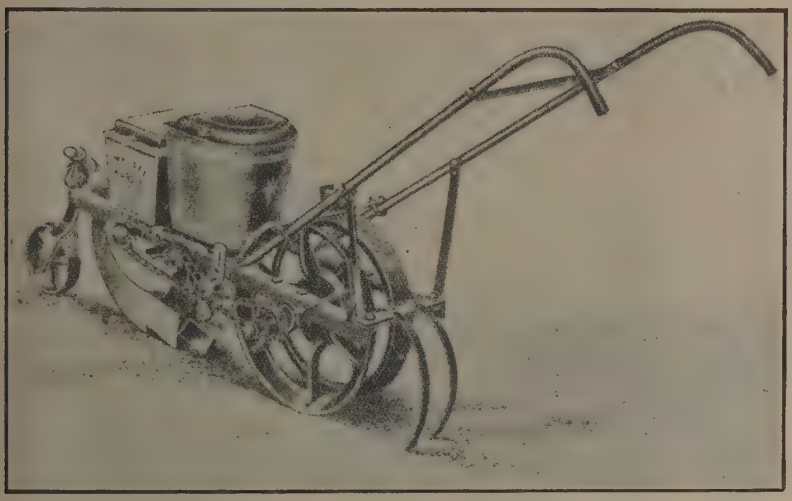
There was no entrance fee, but those who intended to compete were required to signify their intention to the Director of Agriculture not later than 14th December, 1926, at the same time to state the kind of crop or crops with which it was intended to compete, and the area of same. All crops to be planted so that the judging could be completed not later than the end of March, 1927. In the case of sudan grass, which would provide several cuttings, the last not later than 30th March, 1927.

As indicated by the scale of points given above, points were awarded for good workmanship in connection with the planting, to be indicated by the straightness of the drills and the uniform distance apart.

It may be stated that the maize planters which were offered as prizes are not only suitable for planting maize but can be used for planting many other seeds, large and small, such as beans, peas, sorghum, millet, etc. Such an implement will, therefore, be a most useful addition to the plant of any group settler.

Group settlers have a considerable amount of commendable pride in their district, as well as in their individual locations. These competitions aroused some keen but very friendly rivalry, not only between settler and settler, but between groups, and even between the four districts concerned.

The fodder crop competitions were simple, and any group settler could compete whilst carrying out his ordinary work. They provided an opportunity for settlers to show their craftsmanship, and at the same time their knowledge of the art of farming.



A Maize Planter.

The entries received must have been very gratifying to the proprietor of the "Sunday Times" (Mr. McCallum Smith, M.L.A.), as no less than 132 applications were received, made up as follows:—

No. 1 District—Peel and Bateman	48
No. 2 District—Busselton-Augusta	58
No. 3 District—Manjimup-Pemberton-Northcliffe ..	14
No. 4 District—Denmark	12
Total	132

Following on receipt of the entries, competitors were invited to state when the crops would be ready for judging, in order that the Field Officers' itinerary could be arranged. It was only to be expected that not anything like the number of entrants replied, and, for various reasons, there were many withdrawals.

Considerable interest, however, was displayed throughout the group settlement areas, settlers visiting each other and making comparisons, etc., and nothing but good must eventuate.

The results in each district were as follow:—

THE "SUNDAY TIMES" SUMMER FODDER CROP COMPETITIONS.

Maize, Sorghum, and Sudan Grass.

Peel and Bateman.

Judges: Field Officers G. K. Baron-Hay, B.Sc. (Agric). and J. T. Armstrong, B.Sc. (Agric.).

Name.	Weight per acre.				Yield.	Evenness of Growth.	Uniformity of Planting.	Freedom from Weeds.	Character of Cultivation.	Total.
					40	15	15	15	15	100
	T.	C.	Q.	lb.						
O. E. Dudfield, Group 39 ...	17	14	2	25	40	14	14	15	14	97
C. Bridgeman, Group 81 ...	15	2	1	11	34	13	13	14	10	84
W. Peverett, Group 82 ...	11	16	1	26	26½	11	13½	15	13	79
J. Kargotich, Group 30 ...	11	9	11	3	26	12	14	14	12	78
J. Doran, Group 29 ...	11	3	2	0	25	10	13	15	13	76
J. A. McGinty, Group 56 ...	11	4	3	22	25	14	14	10	11	74
W. J. Knight, Group 30 ...	8	13	0	4	19½	13	14½	13	14	74
J. Kieley, Group 45 ...	9	1	2	21	20½	11	13	14	13	71½
W. Bellamy, Group 45 ...	10	0	1	21	22½	12	14	12	11	71½

Winning crop, "Sunday Times" competition. Peel and Bateman Groups. Grown by O. E. Dudfield, Gp. 39. Yield 17 tons 14 cwt.

Busselton-Augusta.

Judge: Field Officer J. M. Nelson.

Name.	Yield per acre.	Yield.	Evenness of Growth.	Uniformity of Planting.	Freedom from Weeds.	Character of Cultivation.	Total.
		40	15	15	15	15	100
	T. C. Q. lb.						
J. L. Murray, Group 48 ...	8 1 3 16	35	12	12	14	12	85
D. McQueen, Group 17 ...	8 9 1 20	37	12	12	14	8	83
N. P. Gore, Group 52 ...	9 3 2 5	40	9	10	13	9	81
A. Oldfield, Group 6 ...	7 6 3 26	32	11	13	13	12	81
E. Hopes, Group 17 ...	7 1 1 18	31	12	9	14	8	74
C. A. Prince, Group 13 ...	5 10 3 5	24	9	11	12	9	65
C. P. Green, Group 36 ...	5 17 3 25	25½	8	12	11	7	63½
W. Mould, Group 59 ...	5 6 0 8	23	7	8	15	8	61
G. Cockrane, Group 60 ...	5 1 3 4	22	6	8	14	7	57

W. Peverett, Group 82, Peel Estate. First crop on new ground.

Manjimup-Pemberton-Northcliffe.

Judge: Field Officer M. Cullity, B.Sc (Agric.).

Name.	Yield per acre.	Yield.	Evenness of Growth.	Uniformity of Planting.	Freedom from Weeds.	Character of Cultivation.	Total.
		40	15	15	15	15	100
	T. C. Q. lb.						
W. Green, Group 23 ...	14 6 0 0	40	14	13	11	12	90
J. Prosser, Group 31 ...	9 3 2 0	26	8	13	13	13	73
W. O'Keefe, Group 10 ...	8 12 0 0	25	11	10	10	9	65
J. Fox, Group 65	5 14 0 0	16	8	10	14	14	62

Denmark.

Judge: Field Officer G. K. Baron-Hay, B.Se. (Agric.).

Name.	Yield per acre.				Yield.	Evenness of Growth.	Uniformity of Planting.	Freedom from Weeds.	Character of Cultivation.	Total.
					40	15	15	15	15	100
	T.	C.	Q.	L.						
S. L. Anning, Group 116...	11	10	2	24	38	13	14	14	13	92
D. R. Hodgson, Group 93...	12	2	1	0	40	10	12	14	14	90
E. A. Russell, Group 42 ...	10	3	1	7	33½	11	14	12	14	84½
G. Osborne, Group 41 ...	11	9	1	2	38	12	12	10	11	83
E. Thomas, Group 41 ...	10	14	3	11	35½	12	12	9	9	77½
D. A. Garland, Group 41 ...	8	2	3	21	27	9	7	7	8	58

Winning crop, "Sunday Times" competition, Denmark Groups. Grown by S. L. Anning, Group 116. Yield 11½ tons per acre.

THE "WESTRALIAN FARMERS" FODDER CROP COMPETITION.

Maize.

Judge: Field Officer G. K. Baron-Hay, B.Sc. (Agric.).

Name.	Yield per acre.				Yield.	Evenness of Growth.	Uniformity of Planting.	Freedom from Weeds.	Character of Cultivation.	Total.
					40	15	15	15	15	100
	T.	C.	Q.	L.						
S. F. Russell (early crop) Serpentine	15	8	3	20	40	10	13	11	10	84
S. F. Russell (late crop) Serpentine	14	11	1	3	37	14	14	9	10	84

S. F. Russell, Serpentine. Winning crop in "Westralian Farmers" crop competition. Yield 15 ½ tons.

THE "MACFARLANE" FODDER CROP COMPETITION.

Lucerne.

Judge: Field Officer G. K. Baron-Hay, B.Sc. (Agric.).

Name.	Yield per acre.	Yield.	Evenness of Growth.	Uniformity of Planting.	Freedom from Weeds.	Character of Cultivation	Total.
		40	15	15	15	15	100
J. B. Daly, Bornholm ...	T. C. Q. L. 5 cuts green. 18 15 0 0	40	14	13	13	*	80

* No cultivation as seed was sown broadcast.

The Judge reported that the crop when cut on 25th February yielded over 2 tons of lucerne hay per acre, which was the fourth cut during the year, and portions will be ready to cut again towards the end of March. This competitor had 10 acres of lucerne, which yielded on the average five cuts per annum, averaging 25 cwts. lucerne hay each.

J. B. Daly's lucerne crop in the "Macfarlane" competition. Yield in one season: 5 cuts = 18¾ tons (green).

The soil is deep red loam, originally bearing karri, with a southern aspect.

Sowing was carried out early in autumn, using 10 lbs. seed per acre, which was harrowed after planting but not rolled, and 2 cwt. superphosphate per acre was applied at the time of planting.

Mr. Daly has found that unless the rains begin early in autumn, so that planting may be completed by the end of April, it is preferable to delay planting that year until the following September.

THE "WILLIAM PADBURY" FODDER CROP COMPETITION.

Sudan Grass.

Judge: Field Officer G. K. Baron-Hay, B.Sc. (Agric.).

Name.	Yield per acre.	Yield.	Freedom from Weeds.	Character of Cultivation.	Evenness of Growth.	True to Type.	Total.
		40	15	15	15	15	100
J. M. Riegert, Yarloop ...	T. C. Q. L. 7 18 1 19	40	11	13	13	14	91

The Judge reported that this was one of the finest crops of sudan grass he had seen. Mr. Riegert makes a specialty of growing sudan grass for seed purposes and reaps as much as 20 bushels of seed per acre. The crop was

J. M. Riegert, Yarloop. Sudan Grass in the "Wm. Padbury" competition. Yield 7 tons 18 cwt. per acre.

very even, averaging 5 to 6 feet high. The soil is semi-swamp clay loam which, unless fallowing is carried out, produces only an inferior crop. The difference in yield between fallowed and unfallowed ground was relatively as 171 to 100.

Mr. Riegert sowed the seed at the rate of 12 lbs. per acre for grain, and 3-4 lbs. for fodder. Fertiliser was applied at the rate of 3 cwt. superphosphate per acre. Other fertilisers have been tried with no better result.

In connection with the competitions, for calculation purposes the heaviest yielding crops in each district were awarded maximum points for yield, viz., 40 points. Crops of less than 5 tons per acre were described as failures.

LESSONS OF THE COMPETITIONS.

It is difficult to draw any definite conclusions from the results, owing to the many varying factors, such as time of sowing, variability of the soil and climatic conditions, extending as the farms do over hundreds of miles of territory. Two or three factors, however, stand out:—

1. *Rate of Seeding.*—The Department's advocacy of a maximum of 20 lbs. seed per acre (for fodder) has been amply demonstrated in all districts: seedings from 25 to 60 lbs. per acre are waste, and yield inferior crops.
2. *Preparation of the land* prior to planting has proved essential.
3. *Intertillage during growth* was a crying need of many crops and one of the principal factors of failure in instances. It must be pointed out that cultivators were not supplied in time in some instances, and in some cases the settlers used improvised implements.

Method of inter-cultivation with Horse Cultivator.

Other features.—It was frequently found that settlers had sown the whole of their summer fodder requirements at one operation, resulting in an over-supply of maximum value fodder at one period, with drying off and withered crop during the late summer when green fodder was urgently required. By working the land well and constantly, plantings could be extended over three or four months, and thus provision made right into May for a maximum value crop for stock. Dairy farmers around Harvey and Brunswick observe this practice and have green fodder from December to the end of May.

The following table will show the areas to be sown at monthly interval for herds of varying size:—

TABLE I.

Area of Maize to sow per Month.

Feeding 30 lbs. per cow per day (10 ton crop).

District.	15 Cows.	20 Cows.	25 Cows.	30 Cows.
	sq. chns.	sq. chns.	sq. chns.	sq. chns.
PEEL ESTATE.				
Sow—September to March inclusive	6	8	10	12
BUSSELTON–AUGUSTA.				
Sow—October to February, inclusive	6	8	10	12
MANJIMUP–PEMBERTON–NORTHCLIFFE.				
Sow—November to February, inclusive	6	8	10	12
DENMARK.				
Sow—November to February, inclusive	6	8	10	12

The yields, in many cases perhaps, will not be thought very large, but when such factors as inexperience, soil variability, lack of cultivation and intertillage, and over-seeding, apart from the fact that, in a great many cases, the land was under standing green timber but a short while previously, are all taken into consideration, the results are highly gratifying, and great praise is due to the donors of the prizes in encouraging this important phase of live-stock farming which will result in such permanent good to the State.

The attached tables set out details obtained by the judges in the respective group districts.

MAIZE CROP COMPETITION—PEEL ESTATE AREA.

Name.	Soil.	Cultivation.	Planted.	Intertillage.	Remarks.
O. E. Dudfield, Group 39	Black peaty swamp ...	Ploughed March, 1926. Cross-ploughed March, 1926. Re-ploughed and harrowed December, 1926. Single furrow plough	January, 1–4, 1927. 20 lbs. per acre	3 times since seeding ...	3½ bags Blood and Bone, half bag Super., per acre. Excellent germination and very even.
C. Bridgeman, Group 81	Black peaty swamp on Folly Flats	Ploughed, April, 1926. Re-ploughed end November, 7in.-8in. Harrowed 8 times and after seeding	First week December, 20lbs. per acre	Moist 3in. down. No cultivation after seeding	3½ bags Blood and Bone, half bag Super., per acre.
W. Peverett, Group 82	Rich peaty loam. Folly Pool Edge, new land	... ...	... ...	... ...	
J. Kargotich, Group 30	Clay loam. Cleared, 1922. She-oak flat	Ploughed 7 inches (wet), and cultivated end October. Two weeks later ploughed, cultivated again, and harrowed	Middle November. 20 lbs. per acre. Continued till middle January	Cultivated once per week	Per acre—4 bags Maize Manure, 1 bag Super. Mulch not deep enough. Too much planted at once, 6½ acres.
J. Doran, Group 29 ...	Loose black sand. Paper Bark and Xmas Bush, new land	Ploughed twice early in October. Fallowed 3 weeks	Beginning November. 25 lbs. per acre. Hickory King	Inter-ploughed, as no cultivator	Manure broadcast. For 4 acres—14 bags No. 2 Potato Manure; 2 bags Super.; 2 bags Blood and Bone. Too much planted at once.
J. A. McGinty, Group 56	Grey sandy loam—moist 2 inches down	Middle November. Spring-toothed twice	December 8th. With cultivator, some tynes removed. 25lbs. per acre. Graded. Too thick	Had no cultivator ...	Very even crop. 7½ cwt. Maize Manure, 1 cwt. Super., 1 acre.
W. J. Knight, Group 30	Deep sandy soil, moist	Ploughed beginning October, and harrowed Reploughed early November, and harrowed twice	Early November. 20lbs. per acre	Three cultivations ...	2 bags Maize Manure; 1 bag Blood and Bone; half bag Super.—per acre. Feeding since beginning January, 11 cattle on 5 acres.
J. Kicley, Group 45 ...	Clay loam. Red Gum and Flooded Gum	Ploughed middle November. Disc cultivated and harrowed	End November. 20lbs. per acre	Cultivated till breast high	Misses due to non-germination. 3 cwt. Maize Manure. Very poor mulch lumpy.
W. Bellamy, Group 45	Part cleared 2 years, and part new land. Deep grey sand, moist	Ploughed August and harrowed	End November. 20lbs. per acre	Twice harrowed. No cultivation since seeding	Very fair crop for soil. Seven bags Maize manure and two bags Super. on 2½ acres. Planted at three week intervals.
J. Wade, Group 30 ...	Sandy loam. Ti-tree and Paper-bark	Ploughed October. Harrowed three times	Middle November. 36lbs. per acre. Too thick	Early January	For 4 acres—3 bags Super., 1 bag Blood and Bone. Stable Manure in furrows. Too much planted at once.

MAIZE CROP COMPETITION—BUSSELTON AUGUSTA AREA.

Name.	Soil.	Cultivation.	Planted.	Intertillage.	Remarks.
J. L. Murray, Group 48	Low-lying grey loam; moist and in good condition	Ploughed May, 1925: December, 1925; October, 1926. Cultivated 3 times (tyne harrows)	Planted by hand, in rows 3 feet apart. Sudan Grass—1st week November, 1926. Maize—4th week November, 1926. Sudan Grass, 5lbs. Maize, 30lbs.	Harrowed 6 days after planting, and again when plants 4 to 6 ins. high	Nice even crop free from weeds.
D. McQueen, Group 17	Chocolate loam ...	Ploughed April, 1926. Cultivated October, 1926 (disc and tyne harrows)	Planted October 10th, 1926, by hand. Rows 3 feet apart. 20lbs. seed per acre.	Cultivated during growth. Hand hoed once	Manure—2½ cwt. maize manure, 1 cwt. Super. Could have been improved by more cultivation during growth
W. P. Gore, Group 52	... ...	Ploughed November, 1926. Tyne harrowed twice	Planted, November 23rd 1926, by hand, in drills. Rows 3 feet apart. 40lbs. seed per acre	3 times tyne harrowed; finally hilled-up with plough	
A. Oldfield, Group 6...	Chocolate loam ...	Ploughed November 15th, 1926. Cultivated November 18th, 1926, with disc	Planted November 20th, 1926, by hand. Rows 3 feet apart. 20lbs. seed per acre	Scarified 5 times during growth	Would have yielded better if planted earlier. Manure—bonedust.
E. Hopes, Group 17 ...	Chocolate loam on bank of creek	Ploughed September, 1926. Cultivated October, 1926 (disc and tyne harrows)	Planted October 4th and 5th, 1926, by hand. Rows 3 feet apart. Millet, 6lbs. Sudan Grass, 10lbs. Maize, 20lbs.	Hand-hoed during growth	Manure—2½ cwt. maize manure. 1 cwt. Super. (mixed).
C. A. Prince, Group 13	Grey loam	Ploughed September, 1926. Cultivated October, 1926	Planted October 15th, 1926, by hand. Rows 3 feet apart. 20lbs. seed per acre	None	Even growth. Heavier yield could have been obtained by intertillage.
W. Mould, Group 59	Grey sandy loam, moist	Ploughed January, 1926. Cultivated October 5th, 1926, with harrows twice	Planted October 5th, 1926. 20lbs. seed per acre	No cultivation during growth	Manure—450lbs. maize manure. 90lbs. Super. per acre. Cultivation very poorly done.
G. Cockrane, Group 60	Grey loam in rough state	Ploughed, Disc., March, 1926. M.B., November, 1926. No cultivation prior to planting	Planted November 15th, December 30th, by hand. 15lbs. seed per acre	Cultivated during growth with hand hoe	Crop very irregular in growth. Manure—2 cwts. maize manure per acre.

MANJIMUP-PEMBERTON-NORTHCLIFFE AREA.

Name.	Date of Clearing.	Date of Ploughing.	How Cultivated.	Date of Planting.	How Planted.	Cultivation during Growth.
W. Green, Group 23 ...	... ...	... ...	Harrowed and cross harrowed	... ...	Drills made by line and hoe. Seed planted by hand	Raked between rows. Harrowed once. Hand hoed once
J. Prosser, Group 31	1924	First ploughing September, 1926	Disced between ploughing and seeding continuously	October 30; November 14; December	Rows made with hoe and line. Seed planted by hand	With Scuffler 8 times. Excellent mulch in sections
W. O'Keefe, Group 10	Partially, 1924. Completed, August-September, 1926	September, 1926 ...	Harrowed September, November 20	November 27; December 7	Drills made by mouldboard. Seeded by hand	Turned over between rows with spade
J. Fox, Group 65 ...	July, 1923	August, 1923; September, 1926	Disc harrowed and again disced	October 21	Rows ploughed in ...	Hand-hoed for weeds and mulch. Latter excellent.

Seed at rate of 10lbs. per acre.

MAIZE CROP COMPETITION—DENMARK AREA.

Name.	Soil.	Cultivation.	Planted.	Tillage.	Remarks.
S. L. Anning, Group 116	Rich alluvial loam. New ground	Ploughed middle December. Disc cultivated. Put in with mattock and raked over	Middle December. 50 lbs. per acre	Hand hoed once ...	Fairly even crop. Planted too thick. No previous experience. 4 bags No. 2 potato manure per acre. Late.
D. R. Hodgson, Group 93	Cleared, July, 1926 ..	Ploughed, August, 1926. Cultivated, November and December. (Disc and drag harrows)	December and January. Ploughed in with small plough. 40lbs. per acre	Harrowed once ...	4 bags Maize manure.
E. A. Russell, Group 42	Karri and Red Gum loam, clay subsoil. New ground	Disc ploughed, October 16th. Reploughed—mouldboard October 30th, cultivated and planted	November 2nd. 30lbs. per acre	Hand hoed every 2 weeks. Best cultivation noted	6 bags Maize manure per acre. Had been planted with Water Couch and Kikuyu. Too thick. Maize, Sudan Grass, Amber Cane.
G. Osborne, Group 41	Karri and Red Gum. Brown clay loam	Ploughed end November. Cultivated and planted	Beginning December. 20 lbs. per acre. Hickory King	No cultivator available	Fallowed one year. 5 cwt. Maize manure per acre.
E. Thomas, Group 41	Red Gum and Jarrah. Wet—paperbarked Ti-tree, brown clay loam	Ploughed and cultivated beginning December. Levelled with jarrah sleeper. Rough ground	Middle December. 25 lbs. per acre	No cultivator available	Planted with Oats last year. Two and two-thirds bags Maize manure per acre. Fairly even crop.
D. A. Garland, Group 41	Red Gum, little Karri. Sandy loam	Ploughed beginning December, cultivated. Planted with Maize Drill	Middle December. 40 lbs. per acre	No cultivator available	Too thick; too late, as on high ground. Three bags Maize manure per acre.

MOSAIC AND LEAF ROLL OF POTATOES.

W. M. CARNE, F.L.S.,
Botanist and Plant Pathologist.

Mosaic and Leaf Roll, known to growers as "Crinkled Leaf" and "Leaf Curl," are found wherever potatoes are grown. In both diseases there is a definite, though at times relatively slow, decline in the total yield and size of the tubers produced. The decline is progressive, the diseases being carried over in the tubers as well as spreading to healthy plants. The decline is more marked in winter grown than summer crops, owing to climatic checks to Mosaic operating in the latter. Diseases of this type are known as "Degeneration" or "Virus" diseases and are undoubtedly the principal cause of the "running out" and disappearance of older varieties.

The first demonstration of the existence in plants of virus diseases was made in 1892 in connection with tobacco mosaic. Since then, and especially in recent years, many plants have been found to be affected with diseases of this type. All have this in common, that they may be transmitted from diseased to healthy plants by a causative agent or virus found in the juices of affected plants and of which the nature is as yet unknown. The causative agent is too small for microscopic recognition, and will pass through filters which will hold back any ordinary type of bacteria. From what is known of their effects it would appear that a virus consists of ultra-microscopic non-filterable parasitic organisms.

Virus diseases are transmitted to healthy plants through some injury to the surface tissues which allows the juices of infected plants to mingle with that of the healthy ones. In some cases infection has been experimentally secured only by budding and grafting. More commonly aphides, leaf hoppers and other small juice-sucking insects are the effective agents of transmission. The virus appears to be carried in the saliva associated with their sucking beaks after feeding on infected plants. In many of these cases, as in potato mosaic, the juices of infected plants may be inoculated into healthy plants by hand with positive results, but in others certain specific insects appear to be essential for transmission.

Seeds of infected plants do not, in most virus diseases, convey the diseases to their progeny, but in a few, such as bean, pea and clover mosaics, seed transmission does occur. Tubers, corms, bulbs, cuttings, etc., do transmit these diseases to the plants raised from them, a most important point to be considered in the control of virus diseases in potatoes.

The virus diseases best known in Australia are those of the potato described in this article, Bunchy Top, the most serious disease of bananas, and almost certainly Spotted Wilt of tomatoes. That this latter very important disease is due to a virus is more than probable, but further confirmation is desirable.

POTATO MOSAIC.

Potato Mosaic or Crinkled Leaf is well established in this State. It is characterised by the mottling of the leaves with light green or yellow spots best seen when the leaves are held up to the light. The leaves are frequently more or less crinkled, and the plants may be somewhat stunted.

Plate 1.—Healthy Potato Plant.

The term potato mosaic really applies to a group of virus diseases receiving its name from the mottling of the leaves suggesting mosaic work. The number of forms of potato mosaic which occur elsewhere is uncertain, and this also applies to the number which occur here; but the most common in this State appears to be the "mild mosaic" of European and American workers.

The appearance of the disease in a crop depends on several factors. Plants grown from tubers from infected plants are almost always affected. Healthy plants may be infected by aphides and possibly by other small sucking insects carrying the virus from diseased plants. Plants so infected may or may not show evidence of the disease, but plants from their tubers certainly will.

Visible evidence of mosaic is affected by growth conditions. In hot bright weather the virus becomes inactive and the symptoms tend to disappear. Consequently apparently healthy crops may be grown in summer from potatoes from an infected crop. However, the disease does not disappear or lose its virulence, and becomes active again in the winter crop. Temperatures of 80° F. and over with bright sunshine and low air humidity cause this masking of the disease. Consequently we find that in the winter crop sown between the end of June and the middle of August the disease is usually very evident. In 1926 Mr. G. N. Lowe, Chief Potato Inspector, reported the disease general in the winter crop, infection reaching as high as 95 per cent. in early plantings in ill-drained land. In such cases yields of only 1½-2 tons per acre were bagged. The disease was unusually evident in that season, a fact which may be connected with a heavy infestation of aphides and thrips in the preceding summer crop. That the effects of the disease may be greater when growth conditions are not favourable has also been noted in America. In the summer crop of the present year, sown in January and February, Mr. Lowe reported that the disease was much less evident, not more than 5 per cent. of infection occurring in the most affected crops, and none at all in crops grown from carefully selected Delawares.

Losses due to Mosaic.

The United States Department of Agriculture estimated the total loss in the United States in 1925 due to mosaic to be 2.9 per cent., varying from 0 per cent. to 15 per cent. in different States. Working on American experience, Chupp (Manual of Vegetable Garden Diseases) estimates that a 30 per cent. infection of the crop will be followed by approximately a 10 per cent. loss in yield. Folsom and Schultz in the State of Maine found that a 45 per cent. infection of the crop meant a 15 per cent. loss of yield, and that 100 per cent. infection of two years' standing meant a loss of 40 per cent. Krantz and Bisby in Minnesota, working with five varieties, found that when grown under rather unfavourable conditions a yield of 4 tons 3 cwt.-5 tons 13 cwt. in 1914 was reduced to 6½ cwt.-14½ cwt. in 1919 by mosaic. When grown under more favourable conditions the decline was less rapid.

Other Plants Attacked.

Potato mosaic will attack many plants related to the potato, such as tobacco, tomato, and the black nightshade (*Solanum nigrum*).

Plate 2.—Potato plant with Mosaic. Photographed to same scale as Plate 1.

Control.

Infected potatoes show no evidence of disease.

From what has been said it must be realised that infected plants produce smaller potatoes than healthy plants. It is obvious then that the practice of marketing the larger potatoes, and the use of the smaller for seed, means an increase each season in the number of affected tubers sown. It is further evident that seed must be selected not from the bulk of the harvested

Plate 3. Potatoes from plants in Plates 1 and 2. Potatoes on left from plant with Mosaic.

crop, but from healthy plants, or in other words, selection must be made of the growing plants and not of the tubers. This idea is at the basis of the system of certified seed instituted by the Potato Branch of this Department. In reference to this may be quoted a statement from the Plant Disease Reporter (U.S.A. Dept. of Agric.) on virus disease in the potato crop in U.S.A. in 1925: "The losses from mosaic and similar diseases would undoubtedly have been much greater throughout the country had it not been for the improvement in quality and the increasing use of certified seed."

There are several methods of obtaining seed relatively free from mosaic:—

1. The use of seed from crops specially selected in the field for their quality and freedom from disease. Seed potatoes certified by this Department have been so selected and can be depended upon to be practically free from mosaic. This has been confirmed in actual experience. Absolute freedom cannot be guaranteed or expected owing to the difficulty of recognising the disease in plants recently infected, or when its presence is masked by climatic conditions.
2. The selection by the grower of healthy high-producing plants in the field, and the saving of seed potatoes from these. This method is reliable only in crops relatively free from virus diseases.
3. The maintenance by the grower of a special seed plot isolated from the main crop (one quarter of a mile if possible). This plot must be kept under close observation, and all diseased plants removed and destroyed when detected. The seed for this plot should be either certified or come from crops practically free from disease.
4. In some parts of Europe and America areas suitable for potato production are known in which virus diseases do not spread owing to the absence of the insect carriers. Where such localities are known they form desirable places for seed raising. Unfortunately, no place in Western Australia is at present known where virus-free potatoes can be raised without careful precautions.

The keeping down of self-sown potatoes between crops, and the control of weeds like the Black Nightshade are obvious precautions.

LEAF ROLL OF POTATO.

This is a second virus disease well established in Australia. It is characterised by the upward curling of the leaflets, the edges turning towards the midrib. Another important symptom is the stiff brittle feel of the leaves, which give a dry rattle when the plants are moved. The leaves may develop yellow or purplish colours, but mottling is not characteristic. The plants may be stunted and may stand stiffly erect. The symptoms are not masked by high temperatures as in mosaic.

As in mosaic, the disease causes a progressive decline in yield and size of tubers. It is also transmitted to healthy plants by aphides and possibly

other small sucking insects. Infection is carried on from season to season in the tubers. Compared with mosaic it is more drastic in its action, but spreads more slowly. According to Chupp it has been found in America that on the average diseased plants give a marketable yield one-third of that of healthy plants.

Plate 4.—Advanced Leaf Roll of Potato.
(Photo., N.S.W. Dept. Agric.)

Control.

The same treatment is recommended as for mosaic.

SUMMARY.

The "running out" of potatoes is to a large extent the result of virus diseases.

Mosaic (Crinkled Leaf) and Leaf Roll are virus diseases common in Western Australia.

Mosaic is recognised by the mottling and crinkling of the leaves.

The symptoms of mosaic are very evident in the winter crop. In the summer crop the symptoms are masked and the plants may appear normal.

Leaf Roll is recognised by the stiff brittle leaves with upward-rolled edges.

Both diseases are carried over on the tubers and are spread to healthy plants by aphides, and possibly other sucking insects.

Both diseases result in a progressive decline in the size of tubers and total yield.

Healthy tubers can only be obtained as a result of the selection of healthy plants.

The practice of using small tubers from the bulk harvest for seed favours the spread of the disease.

The use of certified seed, or seed from selected plants in good disease-free crops, or from carefully culled seed plots, affords an effective method of keeping virus diseases at a minimum.

The use of certified seed for planting more than pays for its higher cost as against ordinary commercial seed.

THE "WHITE CEDAR" OR "CAPE LILAC"

(*Melia azederach*).

A Feeding Experiment with Poultry.

H. W. BENNETTS, M.V.Sc.,

Vet. Pathologist.

A small experiment to determine whether fruits of this tree were likely to be toxic for poultry was carried out at the request of the Poultry Advisor, Mr. Richardson.

The tree is considered to be a very useful one for planting adjacent to poultry houses, being quick growing in this climate, and providing good shade for birds during summer months and shedding its leaves in winter. As the fruits are known to be poisonous for pigs a certain amount of hesitancy was felt in recommending it for use in poultry yards.

Accordingly more or less ripe fruits, being the only ones likely to be accessible to the birds, were collected and were fed to two fowls.

One bird ate six grams of pulped fruit, minus seeds, mixed with mash. The other bird was given whole fruit but showed no taste for it, leaving the fruit almost untouched. All food was accordingly withheld from this bird for a period of two days, except that twenty fruits were placed in the cage. On the third day it was found that eight whole fruit had been eaten. The experiment was then discontinued, neither bird having shown any symptoms at that time nor since.

This experiment indicates that the fruit of *Melia azederach* is unpalatable to fowls, and may be eaten in small quantities without detrimental effects resulting.

It would appear that the tree can be used with impunity for the purpose suggested.

Melia azaderach (18 months old tree).

FIELD EXPERIMENTS AT THE CHAPMAN EXPERIMENT FARM.

I. THOMAS, Superintendent of Wheat Farms.

P. JEFFERY, Manager, Chapman Experiment Farm.

MULCHING EXPERIMENT.

The object of this experiment is to determine how far and under what conditions the cultivation of winter fallowed land is profitable during the spring and summer months. In order to determine this the following system of cultivation was adopted:—

No. 1 Plot was cultivated in spring, after a fall of rain of 25 points or over during summer, and before planting.

No. 2 Plot was cultivated in spring and before planting only.

No. 3 Plot representing neglected fallow was cultivated only prior to planting.

The land on which the experiment was conducted was typical of the Jam and York Gum country, and had been ploughed with a mouldboard plough to a depth of four inches in July, 1925.

The cultivation of the plots, which were each one-eighth of an acre in area, and repeated eight times, was carried out to suit the requirements of the experiment with a springtyne cultivator. Sheep were run on the fallow to help destroy the weeds.

At the time of planting—11th May—the fallow was in good tilth, excepting the neglected fallow plots (No. 3), which were very cloddy. The variety "Nabawa" was sown at the rate of 45 lbs. per acre and superphosphate (22 per cent.) at the rate of 90 lbs. per acre.

The rainfall recorded at the farm during 1926, together with the average for the past 21 years, is shown hereunder:—

Year.	January	February.	March.	April.	Growing Period.						Total, May to Oct.	November.	December.	Total.
					May.	June.	July.	Aug.	Sept.	Oct.				
1926 ...	1	29	25	207	221	370	555	267	192	162	1,767	151	30	2,210
Average, 21 years ...	30	54	51	36	226	427	386	264	169	95	1,567	21	23	1,782

The experiment was commenced in 1914, and since then has been continued each year. In 1924, however, the plots were destroyed by fire before harvesting.

The results obtained last year, together with the average yields to date, are shown in the following tables:—

CHAPMAN EXPERIMENT FARM.

MULCHING EXPERIMENT.

Variety—"Nabawa."—Seed—45lbs. per acre.—Superphosphate 22 per cent.—90lbs. per acre.—Planted—11th May, 1926.

GRAIN YIELDS.

Treatment.	Computed Yields per acre.					Average Yield per acre, 1926.	Percentage, 1926.	Average Yield per acre, 1914-26.	Percentage, 1914-1926.
	Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.				
	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	%	bus. lbs.	%
Cultivated in Spring, after summer rains and before planting	15 20	15 20	15 12	16 48	16 48	15 54	129	16 56	106
Cultivated in Spring and before planting only	13 52	10 48	12 48	12 40	11 20	12 18	100	15 20	100
Cultivated before planting only ...	10 48	11 4	11 44	11 4	10 56	11 7	94	13 52	90

HAY YIELDS.

Treatment.	Computed Yield per acre.			Average Yield per acre, 1926.	Percentage, 1926.	Average Yield per acre, 1914-1926.	Percentage, 1914-1926.
	Section 1.	Section 2.	Section 3.				
	c. q. lb.	c. q. lb.	c. q. lb.	c. q. lb.	%	c. q. lb.	%
Cultivated in Spring, after summer rains, and before seeding	28 2 16	23 0 0	24 0 24	25 1 4	95	26 3 12	106
Cultivated in Spring, and before seeding only	31 0 8	27 0 8	21 1 12	26 3 0	100	25 1 12	100
Cultivated before seeding only ...	28 0 0	20 0 16	27 1 4	25 0 16	94	21 0 24	84

The plots last season were a striking demonstration of the effect of summer cultivation upon the destruction of weed growth. The neglected fallow plots (cultivated before seeding only) were very badly overrun with Cape weed and Double Gees—two very prevalent weeds in this district. The No. 2 plots (cultivated in spring and before seeding) were also badly infested, but not so badly as No. 3, while the summer cultivated plots (No. 1) were remarkably free from weeds. The yields obtained illustrate this more in the grain than the hay, as would be expected on account of the extra weight of weeds in the hay of the less cultivated plots.

Taken over the period during which the experiment has been conducted, the results are strongly in favour of cultivating the fallow in spring and again before planting, and when weeds are at all troublesome judicious cultivation after summer rains should be carried out. The importance of the spring cultivation lies in the fact that when properly carried out, not only does it form a mulch on the surface of the soil, thereby checking evaporation of soil moisture, but also, if done at the proper time, kills weeds and thus prevents them from seeding. The summer cultivations conserve the soil mulch, and also kill the weeds which have germinated after the rain.

The Mulching Experiment at the Merredin Experiment Farm last season showed that the spring cultivation is a factor which should not be overlooked in controlling "Take-all."

FERTILISER EXPERIMENT.

The objects of this experiment are to determine—

(1) whether a small quantity of nitrogenous fertiliser—25 lbs. of Sulphate of Ammonia, applied at planting time—has a beneficial effect upon the yield of wheat crops, and

(2) whether the same small quantity of nitrogenous fertiliser will lessen the need for fallowing.

For the purpose of the trial, three plots were fallowed in July of the previous year (1925), and two plots, situated between these, were left unfallowed. The fallowed plots were ploughed with a 4-furrow mouldboard plough on 2nd July, 1925, and were cultivated with a springtyne cultivator on 25th August, disc cultivated on the 28th September, and with a springtyne cultivator on the 17th and 25th May, 1926, prior to planting. The fallowed land after this treatment was in excellent condition, and free from weeds. The unfallowed plots were ploughed on 20th May and cultivated on 21st May.

All the plots, which were each one quarter of an acre in area, were then subdivided into two, one portion receiving an application of 90 lbs. of superphosphate per acre only, the other, in addition to the same quantity of superphosphate, an application of 25 lbs. of Sulphate of Ammonia per acre.

The variety "Nabawa" was sown at the rate of 45 lbs. seed per acre.

The following table shows the grain yields obtained last year:—

CHAPMAN EXPERIMENT FARM.

FERTILISER EXPERIMENT.

Variety, "Nabawa." Seed, 45lbs. per acre. Planted, 20th May, 1926.

Treatment.	FALLOWED.					UNFALLOWED.			
	Computed yield per acre.					Computed yield per acre.			
	Sec. 1.	Sec. 2.	Sec. 3.	Average.	Percentage, 1926.	Sec. 1.	Sec. 2.	Average, 1926.	Percentage, 1926.
	bus. lbs.	bus. lbs.	bus. lbs.	bus. lbs.	%	bus. lbs.	bus. lbs.	bus. lbs.	%
90lbs. Superphosphate	16 40	16 24	18 56	17 20	100	10 24	14 24	12 24	100
90lbs. Superphosphate + 25lbs. Sulphate of Ammonia ...	15 44	15 36	18 8	16 32	95	9 44	12 48	11 16	91

The results obtained, although for one year only, show that the small application of 25 lbs. of Sulphate of Ammonia at the time of planting did not increase the grain yields on either the fallowed or the unfallowed land. The experiment also emphasises the importance of fallowing. Fallowing is not only responsible for the conservation of moisture, but also during the spring and summer on well-cultivated land the process of nitrification is stimulated, and sufficient nitrates are made available for the use of the succeeding crop.

FACTS ABOUT FOOD-VALUES.

M. A. Wylie,

Inspectress and Organiser, Domestic Science, Education Department.

The classification of foodstuffs was given in a previous issue of this magazine, and in the present article I would remind the reader of the oft-mentioned five groups of foodstuffs, viz., proteins, carbohydrates, hydro-carbons, minerals, and other substances sometimes called nutrients or vita-mines. Foods from each of these groups help to make meals well balanced and appetising.

Summarising, we may say the work of food is—

(a) to build new tissues and repair old ones;
(b) to furnish heat and energy for work and play;
(c) to regulate the machinery of the body in order to ensure normal growth and health.

The proteins, such as albumens (found in meat, milk and eggs), are the builders and repairers of tissue. The carbohydrates, such as starchy material and sugars (found in grains and fruits), supply material for the production of energy, whilst hydro-carbons (fats) give warmth and, under certain conditions, energy. The minerals, such as iron, calcium and phos-phorus, obtained from the outer coats of grains, also from vegetables and fruits, are required for teeth, bones, blood, and tissue generally. Vitamines have a large share in keeping up the normal growth and health of the body.

The material called roughage also plays an important part amongst the foods of the body. This is the bulky part supplied along with certain foods, such as the outer coatings of grain, as bran, or the cellulose or framework of leafy vegetables such as cabbage. Roughage helps to keep the food moving in the digestive tract, acting also as a conveyer of food materials. Bran does this as well as providing nutriment in the form of gluten and minerals.

Insufficient food, and food supplied in wrong proportion and variety, have a deleterious effect upon the body, especially upon that of the growing child. The shape and appearance of the body is affected, the mentality more or less weakened, and a general state of debility is the result.

Good nutrition shows itself in well-developed frame, straight back, legs and ankles, strong teeth, clean tongue, sweet breath, firm flesh with healthy colour, sparkling eyes with clear whites, glossy hair, and energetic attitude towards life in general, and a keen appetite for simple food. Proper food selection is therefore something that everybody needs to understand.

In planning meals always make the best possible use of fresh fruits, vegetables and meats, avoiding the canned variety as much as possible, as the essential vitamines are more or less destroyed in the process of preserva-tion.

To have attractive, pleasing meals it is necessary to plan how different textures and flavours, and sometimes even colours of foods combine. This is not a merely epicurean practice, for we are more likely to eat the right foods if they please eye and nose, and tongue as well. Hence in your meals have foods of different texture: some hard, some soft: some crisp; some juicy. It is good to remember sometimes that the use of left-overs is false economy

of health and time, and even of materials, if it requires undue quantities of fresh supplies to make the former palatable.

The quantity of food as well as the quality of food for each person is of paramount importance: the growing child, or rather the adolescent, requires as much as the adult. Those engaged in heavy physical work require more than those of sedentary occupations. Again, temperature alters conditions and needs; cold climates demanding more than warm.

One of the best ways to estimate the quantity of food needed by a person or family is in terms of calories.

There is nothing mysterious about this term; it is simply the unit of measure of heat or fuel value. As the thermometer shows intensity of heat, the calorimeter shows the amount of heat: the first is measured by degrees, the latter by calories.

There are many tables published of the different foods—classified according to their heat or energy-producing value in calories. The following table is culled (and simplified) from the latest American authorities:—

Proteids:

Milk (1 quart) gives 600 calories.
Skimmed milk (1 quart) gives 300 calories.
Beef (1 lb.) gives 1,000 calories.
Poultry (1 lb.) gives 500 calories.
Fish, fresh (1 lb.), gives 200 calories.
Cheese (1 lb.) gives 2,000 calories.

Carbohydrates:

Bread (1 lb.) gives 1,200 calories.
Bread, whole wheat (1 lb.), gives 1,600 calories.
Shredded meal (1 lb.), gives 1,650 calories.
Oatmeal (1 lb.) 1,800 calories.

Sugars:

Honey (1 lb.) gives 1,500 calories.
Granulated sugar (1 lb.) gives 1,800 calories.
Milk chocolate (1 lb.) gives 2,250 calories.

Hydro-carbons:

Butter (1 lb.) gives 3,400 calories.
Oil (1 lb.) gives 4,100 calories.
Cream, 40 per cent. (1 lb. or 1 pint), gives 1,700 calories.
Bacon (1 lb.) gives 2,600 calories.
Salt pork (1 lb.) gives 2,850 calories.
Almonds, shelled (1 lb.), gives 2,900 calories.
Walnuts, shelled (1 lb.), gives 3,200 calories.

Vegetables (fresh):

Asparagus (1 lb.) gives 100 calories.
Lima beans (1 lb.) gives 550 calories.
French beans (1 lb.) gives 175 calories.
Beets (1 lb.) gives 150 calories.
Cabbage (1 lb.) gives 100 calories.
Carrots (1 lb.) gives 150 calories.
Cauliflower (1 lb.) gives 150 calories.
Tomatoes (1 lb.) gives 100 calories.
Green peas (1 lb.) gives 250 calories.
Dried peas (1 lb.) gives 1,600 calories.
Potatoes (1 lb.) gives 300 calories.

Fruits:

Apples (1 lb.) gives 200 calories.
Bananas (1 lb.) gives 300 calories.
Oranges (1 lb.) gives 175 calories.

Grown people and boys and girls over 12 will probably need on the average at least 2,700 calories per day—men and boys probably more, women and girls less.

Nobody needs to memorise a calorie table. Remember, in general, hydro-carbons yield more calories per lb. than the other groups. Sugars and starches yield about equal fuel value, whilst watery foods, pound for pound, give less than dry; *e.g.*, raisins (1 lb.) give 1,600 calories, whilst fresh grapes yield only 450. In time to come the slogan "count the calories" may become as well known and practised in Australia as in America.

LIVE STOCK AND MEAT.

For the information of readers of the "Journal," the following particulars have been supplied by Messrs. Elder, Smith, & Co., Limited, Perth:—

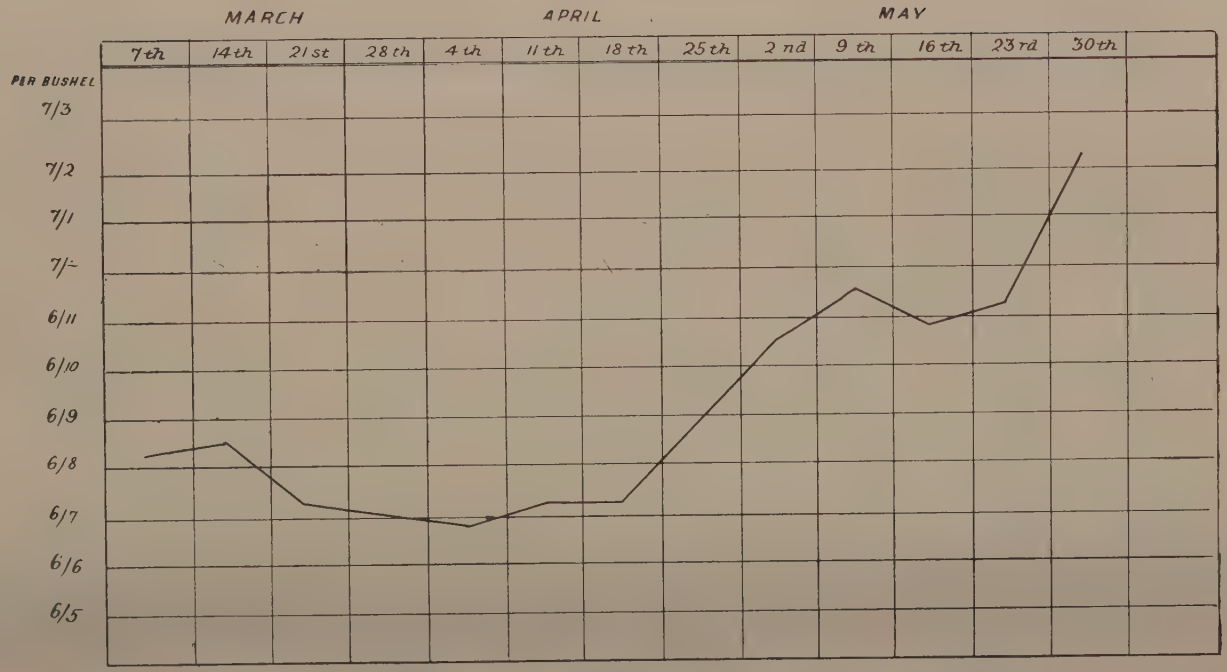
COMPARATIVE YARDINGS OF STOCK AT METROPOLITAN FAT STOCK MARKETS DURING MONTHS OF MARCH, APRIL AND MAY, 1927.

	March.					April,				May.			
	2.	9.	16.	23.	30.	6.	13.	20.	27.	4.	11.	18.	25.
Sheep and lambs	9,164	8,752	9,718	10,971	10,512	8,999	8,614	7,596	6,816	7,349	6,727	11,369	10,146
Cattle ...	677	591	646	696	570	521	620	551	707	643	637	513	641
Pigs ...	1,126	641	821	860	531	834	869	775	1,030	676	894	936	846

COMPARATIVE VALUES PER LB. OF STOCK SOLD AT METROPOLITAN FAT STOCK MARKETS DURING MONTHS OF MARCH, APRIL AND MAY, 1927.

	March.					April.				May.			
	2.	9.	16.	23.	30.	6.	13.	20.	27.	4.	11.	28.	25.
Mutton ...	6½	7	7½	7½	7¾	8	7¾	7¾	7¾	7¾	8½	8½	8½
Beef ...	6	6½	6¾	7	7½	7	6¾	6½	6½	6½	7½	7	7
Pork ...	10½	10½	10	10	10½	10½	10½	10	10	10½	10¾	10¾	10¾
Bacon ...	8½	8½	8½	8½	8½	8½	8½	8	8	8	8½	8½	8¾

RETURN OF WHEAT PRICES PER BUSHEL C.I.F.&E. LONDON



Compiled from Figures kindly Supplied by The Co Operative Wheat Pool of Western Australia

METEOROLOGICAL INFORMATION.

STATIONS.	MARCH. TEMPERATURE. Maximum. Mean.	Maximum. Highest.	Minimum. Mean.	Minimum. Highest.	RAINFALL. For Month.	Average.	APRIL. TEMPERATURE. Maximum. Mean.	Maximum. Highest.	Minimum. Mean.	Minimum. Lowest.	RAINFALL. For Month.	Average.	MAY. TEMPERATURE. Maximum. Mean.	Maximum. Highest.	Minimum. Mean.	Minimum. Lowest.	RAINFALL. For Month.	Average.
					inches.	inches.					inches.	inches.					inches.	inches.
Chapman Farm ... ... State	81·0	99·5	63·3	52·3	52·4	·48	86·1	97·0	58·8	47·1	·35	·46	73·2	90·0	50·5	44·1	2·61	2·25
Geraldton	79·6	97·0	66·8	55·0	41·2	·40	84·0	94·0	64·0	54·2	·57	·85	75·0	89·2	56·4	48·8	3·43	2·77
Walebing	78·9	97·0	57·8	44·0	29·6	·72	82·8	95·1	55·6	43·8	·82	·80	69·0	82·0	44·6	37·0	2·82	2·51
Perth	76·0	85·9	60·6	49·8	18·8	·72	80·8	93·7	60·0	53·1	1·32	1·52	68·8	85·7	51·2	42·7	4·85	4·85
Kalamunda	74·8	88·0	56·3	48·0	21·2	·87	79·8	91·2	59·7	53·0	1·84	1·99	68·5	82·0	50·6	42·9	3·60	6·09
Bunbury	74·2	83·8	56·0	45·2	27·5	1·01	76·5	87·8	56·5	48·8	1·20	1·76	67·5	78·8	49·4	42·4	4·90	5·32
Bridgetown	73·1	84·0	53·1	39·5	30·3	1·01	78·5	89·5	48·2	35·5	2·03	1·66	65·1	81·0	42·5	32·5	4·02	4·57
Albany	67·5	80·4	57·1	48·0	45·3	1·52	72·5	87·0	56·1	49·0	1·24	2·74	65·2	75·6	49·8	36·4	4·42	5·04
Merredin Farm State	77·2	98·3	59·4	44·9	56·5	·90	79·3	91·9	54·9	44·5	36	·79	67·1	80·2	44·3	33·6	·53	1·30
Northam	78·7	95·7	59·5	45·4	31·1	·69	81·8	98·0	53·9	44·0	·27	·82	66·9	84·3	44·2	32·5	1·19	2·22
York	77·7	93·0	58·8	44·0	39·4	·60	81·8	96·0	52·2	43·0	·24	·85	69·3	84·0	43·7	31·0	·88	2·35
Narrogin Farm State	74·4	88·6	53·6	41·1	26·2	·75	78·3	93·2	51·8	43·4	·50	1·18	64·8	80·7	43·7	35·1	1·48	2·81
Katanning	72·7	87·6	53·9	43·0	19·8	·98	77·5	90·7	52·4	45·6	·74	1·19	65·2	80·7	44·4	34·3	·95	2·33
Cape Leeuwin ...	68·7	77·8	60·0	54·6	31·6	1·23	73·6	88·0	62·4	58·0	2·47	2·09	65·5	73·0	56·4	49·5	3·49	5·72

MARKET REPORT.

The following particulars of the approximate quantity of chaff available for auction at the metropolitan chaff and grain sales, held in Perth during the months of March, April, and May, also the minimum and maximum prices ruling for f.a.q. to prime quality wheaten, have been supplied by Messrs. H. J. Wigmore & Co., Limited, of Wellington Street, Perth:—

March .. Quantity—1,400 tons.
Maximum price—£7 10s. per ton.
Minimum price—£7 per ton.

April .. Quantity—2,000 tons.
Maximum price—£8 per ton.
Minimum price—£7 7s. 6d. per ton.

May .. Quantity—1,700 tons.
Maximum price—£8 per ton.
Minimum price—£7 7s. 6d. per ton.

In our last report for this *Journal*, we stated that from reports received from the various hay districts, we were convinced that the quantity of hay cut was considerably less than last season, and that we expected higher prices in the near future. It will be seen by the above that our opinion of the market was correct, and that prices during the last three months have improved considerably. At the time of writing it is very difficult to purchase hay in marketable quantities, especially prime quality. Of course, this market is more or less a weather one, but even should we be favoured with good rains, we still think that present prices for prime quality will be well maintained.

Oaten Chaff.—In March and April supplies were rather plentiful and the market was inclined to be dull. However, during the past two or three weeks very few supplies have found their way to market, and it has been indeed difficult to procure any oaten in the country. It appears as if supplies are short, and prime green samples are selling at around £7 5s. per ton, with f.a.q. £6 15s. to £7; medium samples being in good request at around £6.

Oats.—The market in March and April was steady for good heavy feeds at from 2s. 9d. to 3s., but during the past week or two very few consignments have been available, and good heavy clean feeds have been sold as high as 3s. 7d. per bushel. At the time of writing there is an excellent demand at around these figures, but we are rather inclined to think that once the season is assured better supplies will be available.

Wheat.—The market has fluctuated considerably between 5s. 6d. and 6s., at the time of writing the local market being steady at from 5s. 9d. to 5s. 10d. for f.a.q. There is a good demand for inferior samples, and farmers having any will be well advised to consign to Perth for sale at auction.

WESTERN AUSTRALIA—DEPARTMENT OF AGRICULTURE.

List of Bulletins available for Distribution.

o. 74.—*Tobacco Growing: Notes for Intending Planters.* By G. W. Wickens. Free.
o. 79.—*Sheep on the Wheat Farm and their Management in W.A.* By H. McCallum. Free
o. 83.—*Horticulture and Viticulture.* By A. Despeissis. Price 2s.
o. 87.—*Sheep Feeding Experiments: State Farm, Chapman,* 1920. By G. L. Sutton and F. Vanzetti. Free.
o. 88.—*Light Land: Conference.* By G. L. Sutton. Free.
o. 90.—*Stock Waters: Standard for Composition of.* By E. A. Mann. Free.
o. 93.—*The Home Tanning of Sheep and other Skins.* By H Salt. Free.
o. 94.—*The Dingo.* By B. W. Leake. Free.
o. 96.—*Poison Plants of W.A.* By D. A. Herbert. Free.
o. 99.—*Australian White.* By G. L. Sutton. Free.
o. 101.—*Cotton Cultivation.* By G. L. Sutton. Free.
o. 103.—*Kerosene Method for Eradicating the Zamia Palm.* By G. K. Baron-Hay. Free.
o. 104.—*Stickfast Flea.* By J. G. C. Campbell. Free.
o. 105.—*Pedigree Selection of Seed.* By G. L. Sutton. Free.
o. 106.—*The Red Legged Velvet Earth Mite.* By L. J. Newman. Free.
o. 107.—*Sudan Grass.* By G. L. Sutton. Free.
o. 109.—*Rape* By G. L. Sutton. Free.
o. 111.—*Standard Wheat Varieties.* By G. L. Sutton and F. Vanzetti. Free.
o. 112.—*Automatic Device for Eradication of Stickfast Flea.* By G. Allman. Free.
o. 113.—*Picked Pieces (Classification of Clip).* Free.
o. 114.—*Blue Mould on Citrus Fruits.* By W. M. Carne. Free.
o. 115.—*The Value of Windmills for Pumping Water in W.A.* A. H. Scott.
o. 116.—*Spotted Wilt of Tomatoes.* W. M. Carne.
o. 117.—*Cream.* P. G. Hampshire.
o. 118.—*Pigs and Pig Raising.* P. G. Hampshire.
o. 119.—*Take-all of Wheat and Similar Diseases of Cereals.* By W. M. Carne and J. G. C. Campbell.
o. 120.—*Pastures in the South-West.* A. B. Adams. (Reprint from "Journal.")
o. 121.—*Mildew, Septoria, Leaf Spots, and Similar Diseases of Cereals.* W. M. Carne and J. G. C. Campbell.
o. 122.—*Fruit Fly. Description and Control.* L. J. Newman.
o. 124.—*Government Inspection of Wheat.* G. K. Baron-Hay. (Reprint from "Journal."
o. 125.—*Buy Good Seed.* (Advice to Farmers.) W. M. Carne. (Reprint from "Journal.")
o. 126.—*The Rust of Cereals.* W. M. Carne and J. G. C. Campbell.
o. 127.—*Wheat Yields—Competitions.*
o. 128.—*Woolly Aphis Parasite (Aphelinus mali).* (Hald.) L. J. Newman. (Reprint from "Journal.")
o. 129.—*The Farm Horse: Hints on Feeding.* A. McK. Clark. (Reprint from "Journal.")
o. 130.—*Minerals and the Health of Cattle.* A. B. Adams. (Reprint from "Journal.")
o. 131.—*The Strength of Wheat and Flour.* R. G. Lapsley. (Reprint from "Journal.")
o. 133.—*Kikuyu Grass for Poultry.* G. L. Sutton. (Reprint from "Journal.")
o. 134.—*Flag Smut of Wheat.* W. M. Carne. (Reprint from "Journal.")
o. 135.—*The Objects of Farmers' Trials.* G. L. Sutton. (Reprint from "Journal.")
o. 136.—*The use of the Scythe.* H. Campbell. (Reprint from "Journal.")
o. 137.—*Winter Trapping of the Fruit-fly.* L. J. Newman. (Reprint from "Journal.")
o. 138.—*Clearing Heavily-timbered Pastures.* A. B. Adams. (Reprint from "Journal."
o. 140.—*Surface Draining.* A. R. Clifton. (Reprint from "Journal.")
o. 141.—*Breeding a Permanent Flock.* H. McCallum. (Reprint from "Journal.")
o. 142.—*The Plague Locust.* L. J. Newman. (Reprint from "Journal.")
o. 143.—*Zamia Palm.* A. B. Adams and G. K. Baron-Hay (Reprint from "Journal.")
o. 144.—*Ants as Pests.* J. Clark. (Reprint from "Journal.")
o. 145.—*The Tuart Bud Weevil.* L. J. Newman and J. Clark. (Reprint from "Journal.")
o. 146.—*Development of a Dairy Herd.* P. G. Hampshire. (Reprint from "Journal.")
o. 147.—*Cultivation of the Potato.* G. N. Lowe. (Reprint from "Journal.")
o. 148.—*Maize—The King of Fodder Crops.* G. L. Sutton. (Reprint from "Journal.")
o. 149.—*Lucerne.* G. L. Sutton. (Reprint from "Journal.")
o. 150.—*Subterranean Clover.* A. B. Adams. (Reprint from "Journal.")
o. 151.—*Blow Fly Traps.* L. J. Newman. (Reprint from "Journal.")
o. 152.—*Bee Diseases.* H. L. Cailes. (Reprint from "Journal.")
o. 153.—*Lice and Tick in Sheep.* F. Murray-Jones, L. J. Newman and H. McCallum. (Reprint from "Journal.")

No. 154.—*Branding the Wool Bale.* G. L Sutton and N. Davenport. (Reprinted from " Journal.")
No. 155.—*A Simple Dry Pickler.* G. L. Throssell. (Reprint from " Journal.")
No. 156.—*Forest Pests.* J. Clark. (Reprint from " Journal.")
No. 157.—*Cluster Clover.* W. M. Carne and C. A. Gardner. (Reprint from " Journal.")
No. 158.—*Thorn Apple.* W. M. Carne and C. A. Gardner. (Reprint from " Journal.")
No. 159.—*Bathurst Burr.* W. M. Carne and C. A. Gardner (Reprint from " Journal.")
No. 160.—*Cereal Smuts.* W. M. Carne. (Reprint from " Journal.")
No. 161.—*Tuberculosis in Dairy Cattle.* F. Murray-Jones. (Reprint from " Journal.")
No. 162.—*Sheep Blow-fly Pest.* G. L. Sutton. (Reprint from " Journal.")
No. 163.—*Farm Water Supply.* G. L. Sutton. (Reprint from " Journal.")
No. 164.—*Development of a Dairy Herd.* P. G. Hampshire. (Reprint from " Journal.")
No. 165.—*Jarrah Leaf Miner.* L. J. Newman and J. Clark. (Reprint from " Journal.")
No. 166.—*Trefoil, or Burr Trefoil.* W. M. Carne, A. B. Adam and C. A. Gardner. (Reprint from " Journal.")
No. 167.—*Stinking Roger.* W. M. Carne and C. A. Gardner. (Reprint from " Journal.")
No. 168.—*Stickfast Flea and its Control.* W. T. Richardson.
No. 169.—*Forest Insects.* J. Clark. (Reprint from " Journal.")
No. 170.—*Paterson's Curse.* Carne & Gardner. (Reprint from " Journal.")
No. 171.—*Cockspur Thistle.* Carne and Gardner. (Reprint from " Journal.")
No. 172.—*Annual Birdsfoot Trefoils.* Carne, Gardner and Adams. (Reprint from " Journal.")
No. 173.—*Investigation into Braxy-like Disease.* H. W. Bennetts. (Reprint from " Journal.")
No. 174.—*Costs of Feeding Cows Tests.* P. G. Hampshire. (Reprint from " Journal ")
No. 175.—*Black Spot or Blossom End Rot of Tomatoes.* W. M. Carne. (Reprint from " Journal")
No. 176.—*Exanthema (A Dieback of Orange Trees).* W. M. Carne. (Reprint from " Journal.")
No. 177.—*Lotus Major.* Carne, Gardner and Adams. (Reprint from " Journal.)
No. 178.—*Star Thistle.* Carne, Gardner and Adams. (Reprint from " Journal.")
No. 179.—*Green Tomato Bug.* L. J. Newman. (Reprint from " Journal.")
No. 180.—*Milk and Cream.* P. G. Hampshire. (Reprint from " Journal.")
No. 181.—*Branding of Stock.* A. Arnold. (Reprint from " Journal.")
No. 182.—*Bulls and Butter.* P. G Hampshire. (Reprint from " Journal.")
No. 183.—*Apple of Sodom.* Carne and Gardner. (Reprint from " Journal.")
No. 184.—*Pastures—How manures improve.* G. K. Baron-Hay. (Reprint from " Journal.")
No. 185.—*Black Spot or Anthracnose of Grape Vine.* W. M. Carne. (Reprint from " Journal.")
No. 186.—*Strawberry Clover.* Carne, Gardner and Adams. (Reprint from " Journal.")
No. 187.—*Common Ailments of Stock, and their treatment.* F. Murray-Jones. (Reprint from " Journal.")
No. 188.—*F.A.Q. and other Commercial Standards for Trading in Australian Wheat.* G. L Sutton. (Reprint from " Journal.")
No. 189.—*Trapping Blowflies.* Newman and Clark. (Reprint from " Journal.")
No. 190.—*Perennial Veldt Grass.* W. M. Carne and C. A. Gardiner. (Reprint from " Journal.")
No. 191.—*Citrus Pit.* W. M. Carne. (Reprint from " Journal.")
No. 192.—*Root Rot of Fruit Trees due to Armillaria Mellea.* W. M. Carne. (Reprint from Journal.")
No. 193.—*Broom Millet.* G. K. Baron-Hay. (Reprint from " Journal.")
No. 194.—*Herd Testing.* P. G. Hampshire. (Reprint from " Journal.")
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No. 197.—*Leaf Curl of Peach and Nectarine.* W. M. Carne. (Reprint from " Journal.")
No. 198.—*Spotted Thistle.* W. M. Carne and C. A. Gardiner. (Reprint from " Journal.")
No. 199.—*Codlin Moth.* L. G. Newman. (Reprint from " Journal.")
No. 200.—*The Registration of Bulls.* (Reprint from " Journal.")
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No. 202.—*To Dip or not to Dip.* G. L. Sutton.
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